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THE WILSON BULLETIN

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THE WILSON BULLETIN

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PHOTOPERIODICITY IN BIRDS[1]

BY THOMAS HUME BISSONNETTE

In the spring a fuller crimson comes upon the robin's breast;
In the spring the wanton lapwing gets himself another crest;
In the spring a livelier iris changes on the burnished dove;
In the spring a young man's fancy lightly turns to thoughts of love.
—*Tennyson, Locksley Hall.*

INTRODUCTION

It has long been recognized that various activities of birds are related to the daily cycle of light and darkness and to seasonal change from short days in winter to long ones in summer. In one case notice has been taken of an apparent relation to time at which increasing moonlight from waxing moons in spring adds its stimulus to that of lengthening days. These photoperiodic activities are various and include daily times of waking and beginning of song and bodily activity, daily changes in the periods of sporulation of bird malarias and other typical cyclic diseases, seasonal changes of plumage, migrations, periods of sexual activity and quiescence accompanied by changes in breeding behavior and courtship display.

It is proposed to discuss, rather incompletely, but as suggestively as possible in small space, selected phases of this apparent dependence of the activities and functions of birds upon variations in daily and seasonal illumination as factors in their environment. It is emphasized from the first that many other factors in their environment also affect the physiology and behavior of birds, often more profoundly than do changes in exposure to light. There also appear to be intrinsic rhythms more or less independent of environmental influence. This paper will merely bring out relations to the light factor without excluding others.

Martin said, in "A Voyage to St. Kilda" (London, 1698), "The inhabitants observed that when the April moon goes far in May the fowls (sea birds) are ten to twelve days later in laying their eggs than ordinarily they use to be." This implies a summation effect of length-

[1]Aided by grants from the National Research Council, Committee for Research in Problems of Sex, 1936-8.

ening days and waxing moonlight upon the incidence of reproduction in sea birds. Sharpey-Schafer (1907), on theoretical grounds, suggested that duration of daylight "may well be considered a determining factor in migration, and it has the advantage over other suggested factors that it applies to the northerly as well as to the southerly movement." But he considered it improbable that migration is the result of developmental changes in the sexual organs, since the sex-glands of spring migrants are still almost as small as in autumn. Such early suggestions regarding physiological and behavioristic photoperiodicity of various types as exhibited by birds may be multiplied almost *ad lib.*

Daily Rhythms

Temperature

Kendeigh (1934) has discussed daily rhythms of birds very thoroughly. He points out a daily rhythm of body temperature and metabolism, highest at noon or early afternoon in sparrows and lowest near 2:15 A. M., in part related to exercise, but rising before the birds leave the nest in the morning. Under starvation, very low temperatures, etc., survival time is shortest and loss of weight greatest in the light and longest in darkness or in winter time when periods of light are shortest (63 per cent greater than in summer). Summer birds survive high temperatures better than winter ones, though loss of weight before death is not consistently different. Winter birds have lower metabolic rates, temperature for temperature, than summer birds and greater average weight. Wrens differ from sparrows only relatively in these respects. Average night temperature and number of hours of darkness without food are important factors in survival time under starvation, both related to length of day. Other authors do not emphasize the temperature factor so much but stress duration of daylight and feeding periods. Kendeigh points to daily maximum temperature as the critical factor. Continuous light reduces survival time, at high temperatures. Temperature x hours of darkness constitute the critical factor for survival at low temperature.

Daily Activities of Day and Night, or Twilight, Foragers

There can be little doubt that times of roosting, of evensong, and of return from foraging are controlled by the decreasing of light-intensity and the coming of twilight in birds that hunt by day. With such birds the time of morning song, of leaving the nest or roost, and even cock-crow are related to incidence of daylight and vary in correlation with it (Allard, 1930; Shaver and Walker, 1931; Lutz, 1931; Wynne-Edwards, 1930).

On the contrary, in birds, like flycatchers of some species, night hawks, owls, etc., that hunt by twilight or night, there is increased activity when light-intensity recedes to varying degrees. In caged birds that are migratory there is increased activity at night during the seasons of spring and fall migration for the species (Wagner, 1930).

Mitotic Rhythms in Sex-glands

Foley (1929) and Riley (1936) found a diurnal rhythm of spermatogenesis in sparrows, with active mitoses confined to the period of darkness. Reversal of light and dark periods leads to a change over of these mitoses from between 2:00 and 4:00 A. M. to the afternoon hours. The wave of mitotic activity is dependent upon lowered body temperature. If body temperature is lowered experimentally during the light hours, mitotic figures appear within two hours; if birds are kept active during night hours and temperature thereby kept up, spermatogenesis is retarded. Injections of gonadotropic hormone cause rapid increase in the size of gonads, attributable largely to increased activity at low body temperature at night. Riley reasons that the spermatogenic cycle is controlled by a combination of environmental and internal factors; that reduction of body temperature in the dark period makes the germ-cells responsive to stimulation by the gonadotropic hypophysial hormone.

Avian Blood Diseases

Boughton (1932, 1933) and Boughton, Atchley, and Eskridge (1935) pointed out a diurnal rhythm in avian isospora with diurnal oöcyst production in the sparrow modifiable experimentally by changes in the length of the periods of light and darkness to which host birds are exposed. They conclude that peaks of oöcysts can not be explained as due to ingestion of infective material nor to increased fecal discharge during the feeding periods, which Boyd (1929, 1933) considered to be important in controlling reproductive periods in *Plasmodium cathemerium*, the parasite in canary malaria. They found that the mechanism controlling the periodic production of oöcysts operates in a light-dark period which precedes the appearance of oöcysts by approximately forty-eight hours. Daily activity of the host appears to be the primary factor. Otherwise the reproductive cycle appears to resemble the periodic asexual sporulation of the plasmodium of the canary, in which Boyd (1933) found no relation to fatigue of the host. Wolfson (1936a, 1936b, 1937) also found a relation of plasmodium species (3) to daily light cycle.

Manwell and Herman (1935) find at least seven species of malaria in birds and several others that are as yet questionable. Incidence is higher in migratory birds and in those going farther south than in non-migrants. Ducks and swallows are infected with a malaria-like disease due to *Leucocytozoön anatis*. The infection occurs principally when the birds roost near streams where the black fly vector of the disease breeds. So, much is to be done in study of the relations of these diseases to environmental factors.

Some of these diurnal rhythms of birds and of some of their blood parasites correlated with internal physiological rhythms of the birds are directly conditioned or controlled by the light-dark cycle, while others are only indirectly so through consequent cycles of temperature, physical activity and fatigue, and maximum and minimum consumption of food. Some may therefore be described as primarily photoperiodic; others as only secondarily so. In most cases the complete and exact mechanism involved is still only partly known or open to controversy. Much further study of these phases of physiological activity and behavior is required and this is a most fertile field for ornithological study.

Seasonal Rhythms

Temperature, Basal Metabolism, Thyroid Activity

Since Kendeigh (1934) has discussed these phases thoroughly it is enough here to draw attention to some of the findings bearing on these cycles. Riddle and Fisher (1925) and Haecker (1926) found that thyroid activity is greater in winter cold than in warm summer months. This affects basal metabolism. But Kendeigh (1934) found that winter birds withstand low temperatures better than summer ones, and summer ones high temperatures the better; that winter birds have lower basal metabolic rates, temperature for temperature, higher initial body weights and a lower rate of loss of weight than summer birds, under starvation. Plumage weight is greater for adult birds in winter than in summer. Even in summer it is greater in adult than in juvenile birds. Beebe (1908) and Walton and Marshall (unpublished data) found that plumage changes in some birds (Scarlet Tanagers, Bobolinks, wild ducks) are conditioned by light cycles.

Kendeigh found that the average night temperature plus the number of hours of darkness without food are the important factors in determining survival time of birds under starvation. Groebbels (1927-1932) emphasizes duration of daylight rather than darkness and stresses temperature much less as a factor. Rowan (1931) emphasizes shortness of feeding time per day in winter and short days as a limit-

ing factor which prevents the gathering of enough food by some species. Survival time is shortened by high humidity at high temperatures, by continuous light, increased activity and winds. Species of birds is a factor in all cases. The above factors are related to length of day and intensity of light.

Seasonal Abundance

Shaver (1933) found that the factors related to seasonal abundance of birds in order of importance are temperature, duration of sunshine, relative humidity, wind velocity, atmospheric pressure, and precipitation. This is related to movements of migratory species and, as will be shown below, is related to seasonal and even to daily cycles of light and dark periods. Consumption of food is greater per day in summer than in winter (Groebbels, 1931; Rörig 1905) correlated with higher temperature, metabolism, and activity of many body tissues of which spermatogenesis and ovogenesis are but two.

Plumage

Differences in weight and thickness of plumage with the seasons have been mentioned above. Many birds also pass through one or more changes in type and coloration of plumage each year in correlation with the seasons. Molting occurs in many birds in late summer and early autumn when temperatures are high and the heavier coat is put on at this season (Kendeigh, 1934). For birds in the temperate zones this is just a short time after the change over from lengthening days of increasing light intensity to decreasing intensity and shortening days and the taking on of the heavier coat occurs when temperatures are still relatively high; therefore cold could hardly be a factor in causing the change.

Some species, like mallard ducks, tanagers, bobolinks, lapwings, or even pheasants and domestic fowl, take on a different plumage or assume brighter head furnishings before or at the breeding season, or in autumn and spring to assume less striking colorations at the season for incubation or rearing the young, in contrast to showy breeding plumage. Others like Starlings and sparrows, change the color of their bills under the influence of the hormones from the gonads or the hypophysis, with the seasons. Even the plumage changes have been shown to be dependent upon changed hormone action of the thyroid and pituitary, as well as the sex-glands, and these upon changes in daily period and intensity or wave-length of light (Beebe, 1908; Goodale, 1910; Seligman and Shattock, 1914; Bissonnette, 1930 *et seq.*; Keck, 1932, 1934; Witschi and Keck, 1935; Tallent, 1931; Jaap, 1934;

Miller, 1935; Zawadowsky, 1929; Walton and Marshall, unpublished data; Bissonnette and Csech, 1936b).

Sexual Photoperiodicity

It has long been known that sex-glands, secondary sexual apparatus, sexual behavior, and related activities, including changes of plumage and erectile head furnishings, in many birds are subject to seasonal changes. Tennyson, in "Locksley Hall", wrote the stanza at the head of this paper.

It was taken for granted till recently that these rhythms were conditioned and controlled directly by the succession of warm and cold seasons, through temperature.

Studies on this subject published before 1934 have been reviewed by Bissonnette (1935, 1936c) and Walton (1933) for animals in general, and by Kendeigh (1934) in connection with the influence of environmental factors upon the physiological rhythms of birds. The latter showed that nesting and laying are considerably modified and controlled by changes in temperature. Sudden drops in temperature interrupt nesting and laying and postpone incubation. But these are only secondary variations in the reproductive cycles of birds, superimposed upon a more fundamental primary drive to reproductive activity.

Rowan (1925-37) first showed that reversing the daylight curve in autumn and winter with electric lighting would cause the sex-glands of juncos, canaries, and crows to enlarge and produce sperms in winter instead of at the normal time in April or May. This was correlated with migration and will be discussed somewhat more fully under that topic because much of the work on migration can not be dissociated from that on sexual photoperiodicity. Duplication to some degree can not be avoided unless the two topics are reviewed together.

Weak light from electric bulbs, added after nightfall in increasing periods and then withheld periodically, brought about the breeding condition four or more times in a year. Rowan came to the conclusion, based upon an experiment with increased exercise instead of increased light with birds already well stimulated with light increases, that it was the increasing periods of exercise and wakefulness rather than increase of light, as such, that was the fundamental cause of the stimulation to increased sexual activity in juncos. This he still maintains though he uses light as his activating factor in his subsequent experiments and not exercise, and in the face of increasing evidence that, in all other animals tested and showing this reaction, it is light, *qua* light, that is the primary stimulus. Amount of food consumed

did not appear as a factor in the reaction, at least when it was varied and sufficient to prevent inanition. The work of Bissonnette (1930 *et seq.*) and others supports the statement that amount of food consumed is of relative unimportance. But it is quite evident that inadequate variety of food or improper quality, so far as salts, vitamins, proteins, and fats are concerned, may act as a limiting factor preventing activation by the usual stimuli and may even play a more important rôle in some cases (Bissonnette, 1933b). Longer feeding periods or shorter night periods without feeding have been looked upon by poultry men as the cause of increased laying of fowl in autumn and winter when they are subjected to "night-lighting". But the experimental studies on birds by Rowan (1925-37), Cole (1933), Miyazaki (1934), Benoit (1934-6), Petty (Brill, 1934), Martin (1935), Riley (1936), Scott and Payne (1937), Keck (1932), Kirschbaum and Ringoen (1936), Bissonnette (1930-37), Bissonnette and Wadlund (1931-3), Bissonnette and Csech (1936a, b, c, 1937), Clark, Leonard, and Bump (1936, 1937) and others, and similar studies upon mammals and amphibia (Bissonnette, 1935, 1936c) rather indicate that the larger consumption of food is the result of increased reproductive activity, caused by increased lighting, instead of its cause.

Between 1926 and 1928, Bissonnette (1930a, b) and Bissonnette and Chapnick (1930), and since that time, Bissonnette and Zujko (1936) studied the normal sexual cycle of the European Starling (*Sturnus vulgaris*), a bird which at that time migrated but little in this country. Of all environmental variables studied in correlation with this cycle, the seasonal change in duration of daily daylight periods was the only one which was regular enough to account for the very precise regularity of the recurrence of the various phases of the sexual cycle (Bissonnette and Chapnick, 1930).

Experimental studies were then begun to test the effects of altering the daylength by added illumination, in autumn evenings after sundown, along with those of similar periods of forced exercise, which Rowan (1928 *et seq.*) maintains is the fundamental factor inducing activation of the sexual apparatus in the junco and in birds in general with similar sexual cycles. Experiments were carried on from December to April inclusive, and repeated with variations in subsequent years. Added exercise periods without added light were not effective to induce sexual activity in the Starling and even tended to reduce the size and activity of the testes. Light added for the same periods, on the contrary, was very potent to induce activation of the sex-glands, in males more consistently than in females (Bissonnette, 1931a).

By modifying the experimental method and the previous sexual conditions of the birds used, it was found that increasing exercise periods led to a lag in onset of changes in the testes induced by changes in daylength, whether these changes consisted of increase of exposure to light, inducing increased activity of the testes, or of reduced lighting, leading to decreased activity of these glands. That is, if birds already undergoing increase of activity of their sex-glands stimulated by added lighting were changed from increasing to decreasing periods of light, the testes of those placed at the same time on increased exercise periods continued to increase in size and activity for a considerable time thereafter before undergoing regression or slowed activity. Those not put on increased periods of exercise, but with similar reduction of lighting periods, very quickly went over into regression or slowed down their activity, just as did Rowan's juncos. But the reverse experiment was also performed and birds undergoing regression from reduction of their daily light periods were divided into two groups. For one group the daily lighting was increased but forced exercise was not given. For the other group both forced exercise and added lighting were begun at the same time for similar periods daily. In those with increased lighting alone, there was an early response by increasing size and activity of the gonads. In those with equal periods of both added light and forced exercise, regression continued for a considerable time before activation by added lighting became operative. They then responded with somewhat more accelerated activation so that they often overtook the birds of the first group finally. This was taken to indicate that, while increased exercise was not itself an activating factor, it modified the response to lighting, the major factor in these cases. Of course it is dangerous to reason by analogy from one species to another. But the great similarity of the results of the first group of these experiments to those of Rowan with juncos under almost identical conditions make them highly suggestive; though strictly speaking, as he says (Rowan, 1937), they may prove nothing. They do, however, make it impossible to accept his conclusions for birds in general and show that his are not the only valid conclusions from his data, even with juncos.

Further studies (Bissonnette, 1931b, 1932a; Bissonnette and Wadlund, 1931, '32, '33), aided by grants from the National Research Council, Committee for Research in Problems of Sex, showed that the rate or degree of stimulation of testis activity in a given time varies with the intensity of illumination used. Birds under a 10-watt bulb were slower to reach maximum activity than those under a 15-watt

one at the same distance, and these again than those under a 25-watt bulb, and so on, with equal periods of exposure. Birds with added periods of both light and forced exercise were slower to begin activity, but later often overtook those with only added light of similar intensity and duration. The optimum intensity or duration of the daily period have not been determined as yet; but that such an optimum intensity at least exists is already evident.

The degree of stimulation for Starlings depends also on the color or wave-length of visible light used, not on its ultra-violet content (Bissonnette, 1932a; Bissonnette and Wadlund, 1931, '32, '33). Red is very highly stimulating; green of equal luminous intensity, used for the same daily periods, is not stimulating at all; white is less stimulating than red, probably because of smaller content of red or other stimulating rays. With much lower luminous intensity, violet was not stimulating but the testes appeared to decrease slightly in size as compared with those of controls receiving no added exposure to light. This difference in the effect of red, green, white, and violet lights was not due to difference in heat or total energy intensity, as measured by a thermocouple, but to apparent wave-length specificity. Benoit's (1934 *et seq.*) work with ducks has confirmed these findings in general and even as to most of the details. He finds that green and violet are not stimulating while reds and yellows are. Scott and Payne (1937) with turkeys, find red and white effective, but blue ineffective.

That this strictly localized wave-length specificity in the visible spectrum is not found in all animals was shown by Marshall and Bowden (1934, 1936). They found that for ferrets all wave-lengths tested from near infra-red through near ultra-violet were approximately equally effective. Animals subjected to near ultra-violet had greatly prolonged sexually active periods. Bissonnette (1937), however, found prolonged oestrus in ferrets brought into heat early in spring by experimental lighting with little or no ultra-violet. Beyond these limits Marshall and Bowden found no wave-lengths effective. They found that if time times intensity were constant, approximately constant degrees of activation resulted. So it is evident that, even among birds showing photoperiodicity, all wave-lengths will not be equally effective and the most effective ones will probably vary with different species if not with different strains of the same species.

Improper food, low in salts, proteins, vitamins, and fats, even if sufficient in quantity, acts as a limiting factor which may prevent even

highly stimulating exposures to light from inducing sexual activity or greatly reduce their effectiveness (Bissonnette, 1933b).

No mating or egg-laying under these experimental conditions was observed even in Starlings brought to complete sexual maturity as judged by histological criteria. Such activities in these wild birds must be controlled by factors not permitted by the crowded conditions in these experiments and not by mere histological fitness for breeding (Bissonnette, 1933a, 1933b). Cole (1933), using Mourning Doves, was the first to secure mating and viable eggs in winter with a bird of limited breeding season. These doves, however, breed in captivity normally. Since Cole's experiments, several others have induced birds to breed out of their normal season with good fertility and hatchability. Birds used were the Bob-white (Brill, 1934; Bissonnette and Csech, 1936c), turkeys (Scott and Payne, 1937, cited in Bissonnette, 1936c), pheasants (Martin, 1935; Bissonnette and Csech, 1936a, 1936b, 1937; Clark, Leonard, and Bump, 1936, 1937), ducks (Benoit, 1934, 1935f), Ruffed Grouse (Clark, Leonard, and Bump, 1936, 1937), canaries (unpublished data from several sources), and doubtless many others. Guinea fowls fail to respond to increasing light given in this manner (Scott and Payne, 1937). These birds, like guinea pigs which also fail to respond to similar treatment, are natives of the tropics where the factor of changes in relative length of day and night is small and, probably, the animals did not evolve in such a way as to use this factor as a releasing stimulus to induce or accelerate sexual activity at a season most favorable for survival of the young (Young and his students, cited from Bissonnette, 1936c). Neither do all animals of the temperate zones (spermophile ground squirrel, Moore, etc., cited from Bissonnette, 1936c; and African weaver birds, Witschi, 1935, which retain their original African cycles in spite of removal to Iowa).

In male Starlings, a maximum effect and consistent results were obtained by giving large and immediate increases in daily periods of light rather than by gradually increasing periods, even in autumn when periods of daylight were decreasing. This was not so consistent with females. In ferrets this was reversed and males required gradually increasing periods throughout or they underwent regression of the germ-cells while interstitial cells and accessory sex-organs responded completely (Bissonnette, 1932b, *et seq.*). Success in inducing pheasants, bob-white, raccoons and ferrets, of both sexes, to become fertile and potent at the same time and to beget living young was attained by gradually increasing daily periods of light in autumn and winter (Bissonnette, 1936d; Bissonnette and Csech, 1936a, 1936b, 1936c, 1937).

Rowan also obtained his greatest success with juncos in this way. With male Starlings, filtered red light of 1.7 foot-candles luminous intensity, acting for six hours each night from the start, after nine and a half hours of daylight, gradually decreasing with the season, in a basement room, induced complete spermatogenesis in twenty-three days in December and January. Other combinations including red light did it in eighteen days (Bissonnette, 1931a, 1931b, 1932a, 1936c). Scott and Payne (1937), however, found that if the additional light is given during the daylight hours as increased intensity and not after nightfall, it had no stimulating effect on sexual activity in turkeys.

Normally testis regression in Starlings occurs before June 8 or 15; no birds killed on or after those dates had remained in complete spermatogenesis (Bissonnette, 1930b). But daily periods of daylight still increase slowly till June 21, both in duration and intensity. Prolonged experimental studies, even with most potent schedules of lighting, showed that birds invariably passed the climax of activity after a time and underwent regression. This was due to "throwing out of gear" or development of refractoriness at some part of the sexual mechanism. Maximum size and activity of testes could not be maintained beyond a certain period which varied inversely with the effectiveness of the stimulus used for activation and bore some relation to the length of the other phases of the induced sexual cycle. Animals brought quickly into maximum activity remained completely active for a shorter time than those more slowly activated (Bissonnette, 1936c). This also occurs with male and female ferrets. Long continued injections of gonadotropic anterior pituitary hormones and "pregnancy urine" show this same sort of failure to maintain activity of sex-glands and secondary sexual characters in rabbits, rats, and monkeys (Bissonnette, 1936c, for citations). This has led some to believe that reactions against foreign proteins are concerned. But in these refractory reactions in Starlings and ferrets with photic stimulation there can be no foreign protein to react against, because the animal's own glands produce the hormone against the effectiveness of which refractoriness occurs. Nothing foreign is introduced into the system and no natural hormonic balance is disturbed.

Rapid development of this refractoriness is probably at the bottom of recurrent short sexual cycles with or without ovulation intervening, and rapid recovery leads to repeated cycles in polyoestrous animals. Quick activation followed by quick regressive phases with prompt recovery of activity, or slower cycles, in different species will account for differences in length of oestrous cycles from the five-day

cycle of the mouse to the longer ones of other animals like ferrets and rabbits. The relative length of these cycles may also be subject to environmental interference by various types of stimuli, and may be suppressed temporarily for varying periods by such agents. Some such factor operative in birds is capable of limiting the clutch of eggs laid. It is in some way dependent on the number of eggs in the nest; but how it acts is far from clear.

In December and January, 1931-32, an attempt was made to determine whether the light affected the Starlings through the head. Light-tight hoods were placed upon half the birds in a cage while added exposures to light were made. But all the birds in the cage died from the necessary handling of the birds to put on and take off the hoods, and nothing came of it. From similar experiments with ferrets, however, using hoods with and without eyeholes, it was evident that for them the eyes were the receptors for sexual photic stimulation (Bissonnette, 1936d). Benoit (1934, *et seq.*) has shown that for the duck the eyes are the normal receptors; with eyes removed, the exposed ends of the optic nerves may act as receptors; even the hypophysis itself may be stimulated directly by light to induce sexual activation; but only when thyroids and hypophysis are present. He also found that the red end of the spectrum was effective but not the blue-green regions. Ivanov (1934), however, concludes that in sparrows even denuded skin may act as receptor for this reaction. Martin, Buchner, and Inkso (1933) found that if combs were removed from cockerels their wattles and testes enlarged considerably. So the reception of sexually stimulating light was increased.

The first account of use of night lights to induce autumn and winter laying with poultry dates back to a Spanish book of 1802. Waldorf in 1905 was first to use it in this country (Lippincott and Card, 1934). The response is evident in ten to twelve days. But fowl may be bred to high winter production without night lights and the poorer layers are the most improved by increased light (Whetham, 1933; Kennard and Chamberlin, 1931).

Warren and Scott (1935, 1936) and Scott and Warren (1935) have shown that, among the factors influencing ovulation rate in the hen, light is an important one.

Miyazaki (1934) showed that the mejiro, a green bird of Japan, can be brought into sexual activity and caused to sing its mating song at least three times a year instead of once by night-lighting or "yogai" as it is called. Reduction of daily periods of light leads to molting.

Petty (Brill, 1934), in Oklahoma, induced the Bob-white quail to lay from January 1 in one year and December 3 in another by increased lighting and controlled temperature and humidity; and one hen laid 167 eggs before stopping. He also induced them to "group mate" with two cocks and seven hens, with fertility just as high as with pairs. Fertility and hatchability were good and growth better than normal. Bissonnette and Csech (1936a, 1936c) independently induced Bob-white to lay outdoors from March 22 instead of May 19, in Hartford, Connecticut, with fair fertility and some hatch, without control of temperature or humidity.

Martin (1935), with continuous light from 5:00 P. M. to 6:00 A. M. and feeding for egg-production, from December 5, induced laying beginning January 1. Cold weather did not hamper egg-production. No eggs were fertile before three weeks of laying but after that fertility was high, especially after days began to be warmer in late winter.

Clark, Leonard, and Bump (1936, 1937) found that pheasants, quail, and ruffed grouse all responded to increased illumination in winter by enlargement and activation of the gonads, but failed to continue long enough to secure laying. Bissonnette and Csech (1936a, 1936b, 1937) induced Ring-necked Pheasants to lay fertile eggs beginning on January 15 by gradually increasing their periods of daily illumination from December 16, and induced three hens to lay an average of 105+ eggs each before June 29. The hens, but not the cock, were apparently exhausted by this activity and after ceasing to lay they all died soon after return to the normal daylight conditions. In another experiment five hens and a cock hatched on May 7 were subjected to increasing night-lighting from 151 days of age, October 5. One hen began to lay at 185 days of age on November 8. Ten of the eleven eggs she laid were set and gave 50 per cent fertility and 30 per cent hatch on Christmas day. In nature these birds would not have laid till controls did at April 4 and 5, or about 332 days of age. All these birds were in pens smaller in dimensions than those of controls. So their freedom to exercise was curtailed though it was doubtless prolonged each day. In some later experiments in which similar periods of lighting were given but two pens were subjected to greater disturbance from the public and from observation generally than another pen placed between them, the least disturbed or least exercised pen was the one to lay most consistently and prolifically. Greater exercise and disturbance did not lead to earlier or greater sexual activity (unpublished data).

Sparrows, recently tested by Keck (1932, 1934), Ivanov (1934), Kirschbaum and Ringeon (1936) and Riley (1936), show sexual photoperiodicity. They also show evidence of refractoriness to stimulation in early autumn just after the breeding season, which is not shown by young birds of the season's broods. Witschi and Riley take this to minimize the effect of light as a factor in modifying sexual cycles. But it would seem better to regard it as a reaction against maximum activity which causes lowered susceptibility to photic stimulation. It also indicates that young sparrows in their first year would come into breeding in autumn but for the retarding influence of shortening days. Ivanov's finding that denuded skin as well as eyes may act as receptor in sparrows has not been confirmed by others. Ringoen and Kirschbaum (1937) found that covering the eyes of sparrows prevents even seven hours of added light from inducing spermatogenesis in November when controls were completely activated.

Recent work on mammals and birds indicate that sexually photoperiodic animals, as well as others, have inherent cycles of the anterior pituitary and of gonads, etc., dependent on pituitary activity, which, in the absence of effective environmental factors to modify and synchronize them with the seasons for optimum reproductive success, control the reproductive and other rhythmic activity. Phases of these cycles may be accelerated, initiated in periods of normal quiescence, retarded, or delayed by one or even many environmental variables, of which changes in daily duration, intensity, and wave-length of light and changes in types and constituents of food are two.

The peculiar sexual behavior of migratory birds will be discussed below along with other phases of migration phenomena.

Migration

This form of photoperiodicity has been ably reviewed by Rowan (1926, 1931), Wetmore (1932), Kendeigh (1934), and Thomson (1936) and some additional facts in relation to transequatorial migrants have been brought out by Marshall (1932, 1936, 1937) particularly in his Croonian Lecture and the supplement which followed it. These relate to the special types of sexual photoperiodicity of birds whose migration across the equator and failure to breed in their winter range have been such stumbling blocks to those formulating theories as to its cause and its general relation to more common forms of migration. It is difficult to discuss migration except in correlation with sexual photoperiodicity, because Rowan's work has shown that the two phenomena are closely correlated, in some birds at least. One might well add that tendency to form summer and autumn flocks is

also related to these phenomena. Therefore it is impossible to avoid some overlapping of the following upon the preceding topic.

Riddle, Smith, and Benedict (1932) suggested that the thyroids of migratory birds fail to respond to onset of cold weather by increasing activity while those of non-migratory ones do. Migratory birds have higher metabolic rates than do non-migrants. Kendeigh (1934) believes that spring migrations correspond secondarily with the prevalent temperature of the season; when spring temperatures average higher than usual migration is earlier, and later when temperatures average lower. This is difficult to separate from brighter days due to less overcast skies.

Sharpey-Schafer (1907), as quoted above, points out the need for a regularly recurring environmental stimulus to condition migration such as regular increase and decrease of length of day in spring and autumn. But he felt sure sex-gland fluctuations are not its fundamental internal cause, because in spring migrants these glands are but little larger than in autumn. With this Eifrig (1924) agreed.

Rowan (1925-37), however, in a series of very ingenius experiments with juncos and crows, was led to the conclusion that, for these species, the change in length of day in autumn causes the regression of the gonads which brings on the southward migration or perhaps more properly the restlessness which leads to migration. He concluded that increase in activity of these glands in spring induced by increasing daily exposure to light causes the spring restlessness leading to migration northward (Wagner, 1930). His experiments with crows are suggestive rather than conclusive, at least in regard to northward migration. His conclusion that the birds migrate southward when their sex-glands are either regressing or just regressed and northward when they are becoming larger and more active is supported by Wagner's (1930) finding that caged migrants show pronounced activity at night only at the spring and autumn periods of migration. Rowan's results indicate that temperature is not a major factor in the induction of sexual activity or its suppression, to which he attributes migrations, though Kendeigh (1934) appears still to consider temperature changes a major cause of migrations. Rowan is supported on the temperature question by Bissonnette (1930-1933) and Bissonnette and Wadlund (1931-1933) with Starlings, Cole (1933) with Mourning Doves, Miyazaki (1934) with Mejiros, Petty (Brill, 1934) with Bobwhites, Martin (1935) with pheasants, Clark, Leonard, and Bump (1936, 1937) with pheasants, Bob-white, and grouse, Bissonnette and

Csech (1936-7) with pheasants and Bob-white, Benoit (1934-6) with ducks, and Scott and Payne (1937) with turkeys.

Moreau (1931) and Bissonnette (1932c, 1933, 1936c) have suggested that change in type or scarcity of food may act as a limiting factor though not as an activator, when it becomes inadequate to support reproductive activity. Witschi (1935) denies this, without reservation of any kind, on the basis of the fact that his African weaver birds retained their breeding cycles on a constant food ration for three years in Iowa City. But they were evidently on an adequate diet all that time. That they did not change their cycles does not prove that even their cycles can not be modified by changes in feeding régimes just as Bissonnette's Starlings on inadequate diets were prevented from responding completely to sexual activation by very stimulating exposures to even red light, to which, on adequate and varied diets, they are most responsive. Witschi's birds responded sexually to the inherent cycle of the anterior pituitary without modification by changes in light cycles. Scott and Payne (1937) had already found that the guinea fowl, a native of the tropics, is not sexually responsive to added lighting out of its normal breeding season (Bissonnette, 1936c). Blinded ferrets also show failure to respond to increasing daily exposures to light (Bissonnette, 1937) but show an inherent cycle of sexual activity and quiescence, which, however, cease to be correlated normally with the seasons, as they are with intact eyes. This mammal has a seasonal sexual cycle, like the Starling, conditioned and modified by seasonal changes in length of day. This conditioning is removed by cutting the optic nerves and the animals behave like Witschi's weaver birds do naturally. It is evident, therefore, that in some birds and mammals the inherent cycle of the sexual apparatus is more fixed than in others and less susceptible to environmental interference or less responsive to different environmental factors of which change in length of day and change in food are merely two (Bissonnette, 1935, 1936c). As Bissonnette has pointed out, these cycles are conditioned by various factors in addition to the internal rhythm, depending on the evolutionary and environmental history of the animals concerned.

Rowan (1929, 1936) concludes from his experiments that the migration in autumn is due to shortening days acting not as reduced photic stimulation but as reduced periods of exercise or bodily activity inducing shrinking and decreasing activity of the sex-glands; the spring one to increasing daily periods of exercise, not increasing photic stimulation, inducing enlargement and activation of the sex-glands. With this phase of his theory of migration and sexual photoperiodicity

Bissonnette and his co-workers and Benoit (1934-6) and some others are not in agreement. Nor is it certain that the sex-glands are necessary to the migration cycle. That the anterior pituitary is a necessary part of the mechanism is more probable in the light of recent research and of Rowan's experiments on crows. The probability of an inherent cycle of high and low sexual activity resulting from a similar cycle of activity of the anterior pituitary can not be overlooked in view of the regression of sexual activity in Starlings before June 15 in nature (Bissonnette, 1931, *et seq.*) while days increase in length till June 21 and in luminous intensity till later in the summer. Similar regression also occurs in Starlings, ferrets, fowl, ducks, raccoons, and other birds and mammals under experimental lighting schedules, and also under continued injections of gonadotropic hormones from the anterior pituitary and pregnancy urine (Bissonnette, 1936c).

For birds that do not migrate into the tropics or across the equator, Rowan's hypothesis with the above reservations seems to fit the cases better than any combination of factors including temperature and food yet suggested. Considerable evidence is accumulating, however, that sexual cycles, in birds, mammals, and some other animals, and, probably, migration cycles in birds depend on inherent rhythms of the anterior pituitary more or less fixed in the absence of, or without responsiveness to, external, usually stimulating, factors like light cycles (Bissonnette, 1930-37; Hill and Parkes, 1933, 1934; and others). In many animals, in nature with normal exteroreceptors, these cycles are synchronized with the seasons by response to external factors, of which light cycles may be only one, depending on species, length of incubation or gestation period, and/or the degree and rate of change in the effective intensity of the external factor (Bissonnette, 1935, 1936c; Witschi, 1935; and others). For example, while increasing light activates or accelerates sexual activity in Starlings and ferrets, the sex-glands of Starlings on normal light cycles go into regression before the maximum length or brightness of day in June, and both Starlings and ferrets go over into sexual regression after a time even in spite of experimentally lengthening days and can not be maintained in continuous maximum activity by increasing duration and intensity of light. They become refractory to this type of stimulation and for a time incapable or much less capable of a second stimulation or require much greater degree of stimulus than before the refractory condition sets in or longer time to be activated again. Riley (1936) has shown that this is also true for sparrows. Their susceptibility to stimulation then

increases again and, in the absence of increasing light as a stimulator, the pituitary may again become active, though at a slower rate and later in time than with light or other stimulating factor to accelerate its action (Bissonnette, 1937). Bissonnette's experiments with Starlings and Benoit's (1934-1936c) with ducks indicate that it is light *qua light* and not increased waking periods or exercise that is the major factor directly concerned. Both find that not only is increasing length of day a factor but also increased intensity and larger amounts of the longer-waved rays near the red end of the spectrum. The shorter-waved blue and green are ineffective to stimulate Starlings or ducks; but, with ferrets, all the visible and a little of the very near ultra-violet are apparently equally effective to induce sexual activity (Marshall and Bowden, 1934-1936). This points to species differences in this matter. As pointed out above, Scott and Payne (1937) have shown that for turkeys the light must be of additional duration and not merely added during the day as increased intensity of illumination, possibly because given in that way it is not enough of a relative increase to induce increased response. Marshall and Bowden have shown that if the intensity times the time of additional lighting is kept constant the resulting acceleration of sexual activity in the ferret is approximately constant. If the additional duration is zero, perhaps that would account for Scott's results since additional duration is reduced to zero and the product is therefore also zero.

Kendeigh (1934) has shown that direct endocrinal stimulus is important in migration and he believes the hormones from the gonads, varying as part of the reproductive cycle are most important. Keck (1932, 1934) and Witschi (1935, 1936) have shown that sexual changes in birds are dependent upon pituitary hormones. Benoit (1937) finds that the thyroid is involved as well as the pituitary. Castration lowers metabolic rate as does decrease of thyroid activity (Mitchell, Card, and Haines, 1927; Aude, 1927). Wachs (1926) believes that the physiological rhythms concerned are independent of or related only in time to environmental changes. Length of day or change of intensity of light can have little causal relation to the return of trans-equatorial migrants. Species differ in regularity and types of migration. We agree with Kendeigh that climate includes factors of major importance in controlling migration, distribution, abundance, and behavior responses in many birds. We would add that of these factors changes in duration, intensity, and even wave-length of light with the seasons and the development of refractoriness to the activating factors are of paramount importance, for many species.

Thomson (1936) points out the "inter-migrations" which are superimposed upon the primary or great migrations of many birds. These may even be reverse migrations. They occur in response to adverse weather conditions among weak migrants and do not occur among strong migrants which will succumb to bad weather without retreat. "Abmigration" in ducks is a northward migration in spring by birds that have remained over winter in their original breeding areas. These, with exaggerated migrations by some birds, may lead to invasion of new territory in some seasons. They may also be mere food expeditions and not migrations in response to the normal migration-inducing stimulus. They may depend upon fluctuations in food supply like the invasions of New England by snowy owls about every four years which correspond to the years of maximum population of arctic foxes. These movements are not usually directly north and south. Migrations from more to less arid regions in the tropics, even across the equator, may be of this sort. In Africa, some species are found both north and south of the equator and breed in opposite seasons in the two localities. Some breed in the north of their range and some nearly related species in the south part of their range. One species crosses the equator and breeds in the south and so can feed on winged termites almost throughout the year. This is related to changes in humidity.

The order in which the two sexes and ages reach the summer territories varies with different species. In some, males precede, mixed groups next, and females alone last. In some the first are all young, and old males are last; in some the young come first, then mixed old and young (Starling); in others old birds only, then mixed old and young, and only old birds again last. Rowan showed that adults precede young birds in autumn among juncos, females first followed by flocks of males; the reverse is true in spring. Among golden plover, young birds take a different route and a different time from the old birds. These cases show differences in reaction of physiologically different members of the same species and also sex differences.

Van Oordt (1928, 1931) showed that birds failing to complete spring migration usually have winter or intermediate plumage and inactive sex-glands, which may be due to vagaries of the anterior pituitary. Gotz (1929) found that, if there is an autumn molt, migration follows it immediately; that delayed breeding is followed by delayed molt and migration; that passerine birds with two molts per year are usually migrants. Others see less correlation of molt and migration, since individuals in some species differ from others in relation

of molt to migration. Some spring migrants are even losing body feathers while migrating. Both molt and migration are probably related to the rhythm of the pituitary sometimes in different ways, even depending on the previous experiences of the individual bird. Segregation of species is often shown in large migrating mixed flocks. Few sing on the northward spring flight; none in the autumn flight. Particular communities of some species take different routes habitually and this may lead to extermination of some groups with survival of others. Different routes are often taken by the same birds in spring and autumn. The origins of migration and of these specific and individual differences is beyond the scope of this paper.

Native born Starlings in England do not migrate (Wynne-Edwards, 1929); neither did these birds for some time after introduction into America. But of late they are beginning to do so. Migration can not be a learned habit because in some species the young precede their parents and in some they follow. Thomson (1936) believes that two factors are acting as stimuli to migration; physiological cyclic changes in the bird and seasonal extrinsic factors in their environment. He points out that reversed migration in Rowan's Crows occurred in only a few birds but that they followed the direction usually taken by Crows in their normal migrations. Castration did not inhibit these migrations. He thinks Rowan may be overstating it when he concludes that the southward migration is independent of the gonads, though it is probably so for young birds of the year. He fails to consider the complete results of Bissonnette's work in its bearing on Rowan's conclusions and apparently knows nothing of Benoit's studies on the duck, cited above, and their support of Bissonnette's findings.

Thomson points out, as we did above, that both Rowan's and Kendeigh's theories of migration require modifications to suit transequatorial and other types of migration mentioned above. He agrees with Moreau (1931) that periodicity differs with different species of migrant; that daylight changes apply only to migrations of birds from temperate regions and only in autumn to transequatorial migrants from temperate zones whose spring migration is governed by an internal rhythm which over-rides external factors; that in birds confined to the tropics some other factor or factors must operate. He says the "periodicity is essentially the same in all cases, but it may become linked with different factors in the environment according to circumstances. The inter-related reproductive and migration cycles may both be expressions of a periodicity reflecting the influence of all the external conditions governing the bird's life; the phases of these cycles

may be induced by environmental stimuli of different kinds, or may occur to some extent without extrinsic stimulus by virtue of an inherent rhythm. In some such way the hypothesis of a primary stimulus from the reproductive system may be given general application to various categories of migratory birds". According to our hypothesis, which will be stated below, we need only change "reproductive system" to endocrine system of the anterior pituitary and related glands.

Chapman (1928) points out that the last migrants to arrive are in general the first to leave and that corresponding dates of arrival and departure tend to be approximately equidistant on each side of the summer solstice. He feels that the state of the reproductive organs prompts birds to migrate to nesting sites.

Stimmelmayr (1932) suggested that a particular declination angle of the sun in both autumn and spring is the critical factor in each case acting through atmospheric electricity, just as he ascribes orientation for the homing reaction to electric currents not as yet demonstrated. But Besserer and Drost (1935) have shown that, with these possible electric factors excluded by insulation of the cages, the birds still show "migration restlessness".

Thomson (1936) thinks that, for most cases of migration, weather is capable of acting only within narrow limits on birds already stimulated by the primary factor to a state of unrest. For those with "weather movements", however, it may act as more than a secondary stimulus. The autumn departure date is modified by falling temperature and high barometric pressure in conjunction with individual physiological states (Nice, 1933). If approximate date of migration depends on seasonal rhythm of the bird and its environment, and exact day on immediate weather conditions, the precise moment of flight often depends on intensity of light, even to a particular degree of twilight for nocturnal migrants (Drost, 1930, 1931).

As to path of flight on migrations, Stresemann (1935) suggests that the angles of inclination and declination of the earth's terrestrial magnetism at different places acting on statoliths in the birds' ears may act as a stimulus to guide them on flights till the right ones are reached. But, since members even of the same brood may migrate in different paths, there would seem to be no general rule operative in all cases. This may or may not be related to light. We have not enough data to decide (Thomson, 1936).

If one may be at least condoned for attempting to put forward as a working hypothesis a suggestion as to the interaction of intrinsic and extrinsic factors in bringing about migratory flights and failure to

breed in the winter range, the following may be of some interest and stimulation to further study of sexual and migratory photoperiodicity.

Recent research on the physiology of the hormones of the anterior pituitary, gonads, and thyroids indicate that there is, in many animals at least, an inherent rhythm of activity of the pituitary of varying duration of cycle and of phases of that cycle. The gonads, accessory sexual apparatus, and behavior are subject to control by the pituitary and thyroid as shown above. This rhythm is in some animals capable of stimulation, inhibition, or retardation by extrinsic factors of which changes in daily periods of light and in food are two. If so, or if not, the sex-glands and pituitary reach a maximum phase of activity but can not be maintained beyond a time which varies with the species and the rate at which they have been caused to come to this maximum. The whole complex of endocrine action on which the sexual cycles depend goes over into regression of varying rate and degree and a refractoriness of varying duration results. These are the facts.

The sexual and migration cycles are corelated with those of plumage and the pituitary-thyroid complex. If the progress of regression of pituitary and gonads during the refractory phase, which develops with or without extrinsic inhibition, or even in spite of stimulation by increasing days or other lighting changes, is slow and of considerable duration and if flocking and southward migrations of many birds are dependent on it, the southward flights may take the birds to or beyond the equator. Rate of flight may also help to determine the distance flown southward. If in young birds of the year shortening days induce an autumn regression of the pituitary when activation would otherwise occur, their first southward flight will be accounted for. If the refractory period of this endocrine system is prolonged after southward flight stops and before the recovery phase of the cycle begins, also more or less spontaneously, or the birds become responsive to longer days, failure to breed in the southern or winter range results. Detention in that range, however, should be followed by a breeding cycle there. That this does occur with European storks in captivity in Lima, Peru, has been pointed out by Murphy (1925, 1936) and Marshall (1937).

On recovery of the pituitary, begun even with days not increasing, or when not completely inhibited by a steep enough falling gradient of day-length or other factor to which the birds respond, the birds would be stimulated by pituitary activity to the reverse reaction and fly northward or toward their summer range before or while their sex-glands begin progressive changes which culminate, or reach such a

point as to induce migration to stop, and mating, nesting and incubation to occur, at a time and place depending on the species and perhaps on their original birthplace and region of early acclimation (Cole, 1933). These last functions are conditioned by hormones from the anterior pituitary (Riddle and his co-workers).

This return to activity of the pituitary and sex-glands may occur in some animals even in spite of great reduction of effective day-length as indicated by experiments on ferrets, mammals whose sexual cycles are partly controllable by changes in daily lighting just as are those of juncos, crows, starlings, canaries, doves, mejiros, ducks, etc. (Hill and Parkes, 1933, 1934; Bissonnette, 1936c, 1937; Benoit, 1934-6).

Prolonged refractory periods following maximal activity with or without environmental stimulation by light or other factors, would supply the necessary delay to prevent even trans-equatorial migrants from breeding in their southern range. Recovery of the activity phases of the pituitary cycle, even without environmental stimulation at first, will account for the start northward and the reactivation of the sexual apparatus, in various degrees of correlation with each other, depending on the evolutionary history of the species.

This would give a single theory to account for the behavior of all true migrants, whether controlled by seasonal changes in illumination or not. But much testing, both in general and in detail must be done before this theory can be more than a working hypothesis. That it is reasonably easy to test, both experimentally and by observation of birds and their movements in nature, is beyond question.

That the primary agent to modify the cycle is change of periods of exercise is improbable in view of Bissonnette's and Benoit's studies. Also, the long-continued flight southward, coming in some birds at night after feeding by day, would induce reactivation of the gonads if increased exercise were the major factor inducing northward migration and sexual activity, if the refractory period were not too pronounced to be overborne by it. In fact Rowan's castrated Crows migrated southward in the autumn condition (Rowan, 1932). This would suggest that the cause is more fundamental than the reactions of the gonads. One thinks of the anterior pituitary as the more fundamental agent.

Cole (1933) suggested that different geographical groups of some species may vary in their response to light;hence their distribution; though light is not the only factor operating (Bissonnette, 1932, '33, '35, '36; Davis, 1933; Lock, 1933; Linsdale, 1933; Witschi, 1935). Variations in their refractory periods and in the time at which they

reach mating and nesting phases of recovery would account for their place of taking up these activities and for their summer distribution. This may be related to their birthplaces and early conditioning during their first summer. Bissonnette (1935, 1936c) suggested this probable control of migration by the anterior pituitary, and Allard (1928) suggested that length of day is the probable environmental factor most concerned in setting off migration urge, but that it could apply only to birds subject to lengthening days in spring in their southern range and also during their northward flight.

It is likely that different species are conditioned by different factors in their environment, some already known, others not yet determined; and the same species may be responsive to more than one factor. Enough importance has not hitherto been given to the occurrence of the refractory state or phase after varying periods of maximum activity of the endocrine systems. These develop in spite of increasing intensity and duration of the normal extrinsic stimulus. The degree and kind of response differs in different species. The inherent rhythms are perhaps more dependent on this regularly recurring refractoriness with temporary regression than upon the occurrence of recurring stimulation. Recovery may be, and probably is, spontaneous in the absence of conditioning by external factors or when animals are not inhibited by decreasing amounts of stimulation. The frequently repeated cycles of polyoestrous animals including birds may well be determined by the quicker arrival at the refractory phase followed by quick recovery without great susceptibility to stimulation or inhibition by external factors or changes in them. This may be the determining factor in birds that have two or more broods per year in contrast to those that have but one. It may also in different degree be responsible for the different times at which different species and even different groups of the same species begin their flights in migration. Age and sex differences may furnish the physiological differences in condition which cause one bird to react at one time, another at another. It would also account for the different times at which birds arrive in the spring.

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THE MOCKINGBIRD IN WESTERN SOUTH DAKOTA

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The arrival of Mockingbirds at our grove in May, 1936, brought to us the pleasant expectancy of a number of days of unusual entertainment, and the recollection of visitations of other years, but no more than a promise of the eventful season of observation and enjoyment that was to be ours.

In our twenty-six summers on the plains, Mockingbirds (it is the western form, *Mimus polyglottos leucopterus*, with the larger white wing patches, which comes to this southwest corner of South Dakota) had been rare. The first was noted perhaps twenty years ago, unmistakably, for we had known the Mockingbirds of Arkansas and Illinois. He stopped for a morning's rest and inspection of the relatively new homesteads and young trees. The tally of those that had been seen prior to 1936 was no more than seven, including two pairs in different seasons. One pair had remained for thirteen days.

On the morning of May 2 bold and ringing notes were heard, and the new visitor was eagerly sought out, for to be able to see and to

watch the performance of a brilliant and distinguished singer is no small part of one's satisfaction in hearing his recital. This bird proved to be delightfully friendly and fearless, coming now and again to the trees nearest the house, occasionally using as a stage an adjacent shed, or the house chimney. His excellent repertoire included calls of the Bluebird, Bluejay, Meadowlark, Catbird, Robin and, somewhat rarely, those of the Goldfinch, Grackle, and Shrike, and his imitation of the common, noisy small talk of the English Sparrow was nearly perfect. As with others of his kind the greater part of his song was made up of elements we could not distinguish, though several phrases, we felt, from their frequency, must have been gleaned from his sometime neighbors with which we were unfamiliar. Then, too, it seems probable that some songs are disguised by the Mocker's own vivid and intense nature or by his vocal restrictions.

One of our earlier friends, I recall, had spent much time practicing a certain *prair-e-chick, prair-e-chick*, hesitating and prolonging the first syllable, slurring the seccond, accenting and staccatoing the last. His production never seemed to quite satisfy him. Instead of his usual rapid changes he would often sit quiet a moment or two before going on, or returning for another try at *prair-e-chick, prair-e-chick*. Another bird by practice or superior endowment had become a past master at Bluejay imitation. He would give the jay's explorational or arrival call of *jay, jay, jay!* and follow it immediately with a repetition that gave the effect of a sociable fellow amid numerous friends in the upper branches of red oaks at a little distance; and as often would continue with a *jay, jay, jay!* that you would say came from deep woods two hundred yards away, if you had not observed the actual enunciation; all this practically on the open prairie, for our trees, even today, are relatively small—there are no red oaks on the dry, high plains—and without changing his post.

It was not until the tenth day that we got sight of a second bird, which we were sure had been about from the beginning. Now we checked the days carefully, hopeful that the previous fateful record of thirteen would be exceeded. It was. The delightful concerts were continued, at dawning, the morning long, at high noon, often throughout the afternoon, well into the night; not so much through the night, it seemed, as with the birds of Illinois; near the house he sang, here and there through the grove, much of the time in a neighboring grove, that of my parents, similar in extent, four or five acres, and separated by a bit of meadow and a road.

As the days advanced well into late May we began to wish fervidly that the season might not be too unkind, that the supplies of water, seeds, insects, whatever else might come in the line of necessities would prove ample for the summer, so that our birds would not find it obligatory to retreat the eighteen miles to the south across the line into Nebraska, the recorded northern nesting limit of the species.

About this time shrikes began to make themselves much too obvious. The singing, all the habits of the Mockingbirds were continually interrupted. No actual contact battles were witnessed, but the days came to be filled with skirmishings. Neither shrike nor Mockingbird seemed to gain an advantage. The thrilling dark gray and white was pursuer as often as the bullet-like pearl-gray, white, and black. There was, however, this difference: the shrikes were more or less at ease in their usual rôle, while the Mockingbirds impressed one as brave but very much annoyed. By the third or fourth day the leader of the Mockingbirds, too hard pressed, was tiring, and nerve strain had become evident. We were compelled to take a part. Mrs. Barr, as "gunman", went out with the .22 and easily "got" two of the shrikes. The others became wary but within a few days three more were downed, and the one or two that hung about a few days longer gave no trouble. The Mockers accepted the relief promptly, and all was well, as indicated by the floods of song that were poured out again.

It was a week or more after this that Mrs. Barr hurried out with the .22 in answer to a shrike call. It seemed to come from the end tree of a row of silver poplars. The Mockingbird was there upon a high twig, unafraid, giving out an occasional note or two. The shrike could not be sighted. At last, as she was about to turn back to the house, the shrike call came again, at close range, and the Mocker himself was discovered to be the guilty party. This incident would have given fitting denouement to the shrike episode but that, still later, shrikes did appear again. They listened to the Great Mimic's shrike song, slunk away to a low corner of the orchard, sat, bewildered, in a cherry tree for an hour or more. And the final end was that they silently folded their tent and beat it.

In early June a nest was found about six feet from the ground in the crotch of a twiggy lower limb and the trunk of a dead Norway poplar. The tree had been retained for winter windbreak effect and headed back to twelve feet to prevent possible breaking and damage to interplanted pines and ashes. The nest was open to the sun until mid-afternoon but had a secluded location in being beyond the orchard, in the least frequented part of the grove and near to a dense,

tall hedge of Russian olive. It was a large nest, built mainly of rather coarse sticks, and impossible, perhaps, for a novice to distinguish from the nest of a shrike. It was, possibly, a trifle deeper and certainly not so well lined, rather coarse rootlets composing the finish. There were but three eggs, greenish gray, spotted dark brown.

The discovery of the nest was of extreme import, for the authority for the region ("Birds of South Dakota", by William H. Over and Craig S. Thoms) states: "South Dakota is north of the range of the Western Mockers, although they are occasionally seen in the Black Hills or along streams on the adjacent plains", and added this remark, "The Mocking Birds have no equal as singers, and it is hoped that by kind treatment they may become regular summer residents of our state." A second point of interest is that this chosen summer home was not near a stream, but near the height of land between the Cheyenne and the White Rivers, and with no group of native trees that could be termed a grove closer than seven or eight miles, and as much as thirty miles in other directions. Nor is there any other planted grove of equal size, and few of any description within this extensive, naturally treeless area. Attracting these rare visitors was a triumph of wholly man-made environment.

Also of note were the extremes of drought and temperature that characterized the season. From June 1 to September 1 only a few light showers fell, no one of them wetting the ground as much as an inch and a half. Along in July the temperature many times exceeded 112 degrees, a high of 115 being recorded by the nearest official thermometer. Through late July and the month of August all known supplies of water available to the birds within many miles were exhausted. Absence of all water for extended periods is not a new obstacle to Meadowlarks and Horned Larks and a few other less frequent species, which on such occasions do not move out. As at such times no dew falls, it is believed the birds obtain their moisture needs from insects devoured, or from fruit, in the case of those which come to the grove. The Mockingbirds stayed through to September.

On Sunday, June 7, Prof. A. C. McIntosh, of the South Dakota State School of Mines, observed the rather shy mother bird of the nest, and identified the eggs. Prof. McIntosh had known Mockingbirds in Indiana. We were agreed that the western bird differs from the southern chiefly in the darker, less showy tone of the gray color. The book of South Dakota birds notes that the western form is distinguished by a brownish tinge below and larger white wing patches. The individuals we observed here were not soiled white below, as the southern

form is described, neither distinctly brownish-tinged, but gray, a somewhat lighter tone than that of the sides and back, and decidedly lighter at the throat. A faint brownish tinge might fairly be said to pervade all the gray parts of the plumage.

The Great Mimic had been spending more and more time at the neighboring grove, vocalizing much in a certain silver poplar near the house, and convenient to a closely set row of cedars. Mrs. Barr was intrigued as to his particular interest there. From an upstairs window she saw the birds entering a dense, low cedar, and there a nest was found, only five feet from the ground, quite filled with nearly fledged young.

A mystery, somewhere. This was a day or two after Prof. McIntosh's visit. On Friday of the same week I looked again into the first nest, and counted three young, two or three days from the shell. Less than a week later the nest was empty. The nest itself was apparently undisturbed, so the suggestion that a bullsnake had raided it is as good as any. But the male parent of the first nest? Polygamy, as an answer, was hardly satisfying. Doubtless there was a male bird, shy to an extreme, and doubtless it was he that authored the songs we heard a few times at a distance, when the Great Mimic was somewhere near, and loud. Perhaps a young fellow. We do not know that we ever saw him.

The summer grew hotter and the Mimic's family made greater demands; singing became intermittent, finally almost ceased, so that we came to ask one another whether the Mockingbirds had been seen during the day. But when his brood left the nest there was glorious singing. A day, two days, and then . . . There must have been a curtain lecture, perhaps a series. The old boy got right back to business. Friend wife had not come to Dakota for a pleasant vacation, there was work to be done, a mark to set. And good work was done. It is of record that but one of that brood met ill fate, from a cat. Further, on July 12, in the very silver poplar that had witnessed so many of the Great Mimic's public successes, and about fifty feet from the cedar of the second nest, a third nest, about eight feet from the ground, was found, already comfortably full of half-fledged young. Four or five, I should say, not venturing to move the step-ladder close, they were so wide-awake. At this date and later the earlier brood, frequenting the ease and umbrage of the air-conditioned pines, continued to receive a degree of supervision and a part of their food. No wonder there was hardly time for a phrase of song, only for the brief, routine signals of business.

But at that there were the cats to be looked after, particularly Mother's big gray tiger that lived on the steps or about the coal-shed, and prowled here and there with the least possible judgment, and the dog. The cat, if out away from his sleeping quarters, often came in for uncomfortable, cringing moments as the Mimic darted about him, almost touching him. It was part of the ritual, especially in the early forenoon, when the Mimic had captured worm, moth, or grasshopper, to look into the deportment of the cat at the moment. Food in bill, he would perch upon the peak of the coal-house, no more than twenty feet from the kitchen porch steps, and repeat his scolding note until content that all was well. If the enemy was in view, even asleep or otherwise uninterested, the scolding might be kept up for as long as twenty minutes, the food at last delivered to the waiting young. An observing critic might discern in this by-play a temperamental need for stage stuff, especially as the other birds did not find such performance unavoidable. And the threats directed at the dog, even to alighting on his back; it is hard to determine the genuine occasion of that. Unless this dog, retaining a puppy-like fondness of pursuing any small flying thing, even such small prey as grasshoppers, had at some time been caught by the Mimic in an ill-considered act.

Just back of the coal-shed and a line of the quadrangle of evergreens stood a group of mulberries, densely foliaged, stunted trees, and Mockingbirds were often seen there. The group was, perhaps, good hunting ground, or a shelter from the intense sun as were the pines and cedars, or merely a way station to the coal-shed lookout, as seemed likely. Yet when the leaves had fallen in October there was disclosed a used nest of the year, by all the characters a Mockingbird's nest. Can it be that the pair whose first nest was broken up came and nested here successfully?

During the great heat of the summer all living things sought shelter from the sun at every opportunity. The young birds were seldom in evidence. Never more than five birds were observed at one time, with usually an old one or two in the number. On September 2 or 3, four, which I took to be young ones, were playing along a barb-wire fence eight or ten rods to the east from the grove. It was the only time any of them were seen so far from the trees. On the third an old bird was noted once or twice. Early the next morning I may have heard a call note; I listened, but it was not repeated. The season was over.

Smithwick, S. D.

JOHN MAYNARD WHEATON

BY MRS. H. J. TAYLOR

John Maynard Wheaton, valued citizen; trusted and beloved physician; naturalist and pioneer ornithologist; was born in Columbus, Ohio, May 18, 1840. He died of tuberculosis, January 28, 1887, leaving a wife and a son eight years old. He is buried in Green Lawn Cemetery in Columbus, Ohio.* His years, though few, bore rich and lasting fruit.

Sketches of early ornithologists are written not alone for the history of ornithology but also to present in brief and tangible form the most valiant, picturesque, and outstanding representatives in this field of natural history at a time when birds and butterflies were not in the curriculum, and entomologists and ornithologists were delicious subjects for the cartoonist. Such a contribution was made to Ohio ornithology by John Maynard Wheaton.

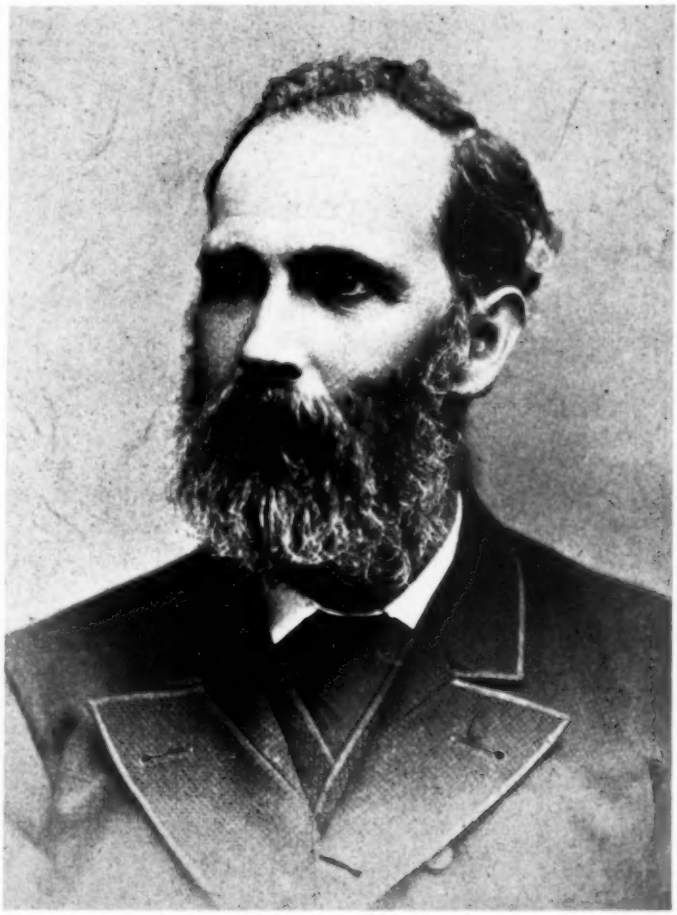
He was educated in the public schools of Columbus. On completion of the high school course in 1857 he entered Denison University, a Baptist school at Granville, Ohio, graduating with a B. A. degree in 1860. The school at Granville was undoubtedly selected because of the devotion of his parents to the Baptist Church and the prominent part his father took in uniting the Welsh and English Baptists in 1835 into the First Baptist Church of Columbus. Dr. Wheaton was a loyal member and supporter of this church throughout his life.

On graduating from Denison University in 1860 he entered the office of Dr. Starling Loving, taking the course offered in the Starling Medical College. The Civil War broke out and immediately upon finishing his course Wheaton enlisted as assistant surgeon in the 188th Ohio Volunteer Infantry. At the close of the war he returned to Columbus and began the practice of medicine.

He fitted up an office in the old family home on Fourth Street where he was born and where his father died. Here, too, his mother died in 1884. He reserved a room for bird cases, another was set aside for butterflies, beetles, snakes, and other natural history objects.

John Wheaton was a thorough, painstaking student in all he did. In 1867 he was made Professor of Anatomy in Starling Medical College which position he held until his death. He was a rare teacher greatly beloved by his students. In his time the "Family Physician"

*Data for this sketch were obtained from Mr. Robert J. Wheaton, son of Dr. J. M. Wheaton, and from such persons as had known Dr. Wheaton as physician, friend, or naturalist. Similar information is contained in "An Ohio Ornithologist", by Osman C. Hooper, in The Honey Jar, Columbus, Ohio, Vol. XVII, No. 2, p. 17.



JOHN MAYNARD WHEATON, 1840-1887

was a distinct figure in the community and held an abiding place in the hearts of grateful families. There are more than a few even today who recall him as the beloved doctor of their childhood days. His ability, sincerity, and friendly personality endeared him alike to adults and children. Professor W. H. Siebert (June, 1936) writes: "My grandfather who often went bird hunting with Wheaton would have only Dr. Wheaton to attend his family in sickness. He frequently took me with him to the Doctor's office where I saw his numerous specimens, not only of birds, but butterflies, beetles, snakes, and other objects. He was a spare man above medium height, kindly, considerate, and lovable with a pleasing voice. He was charming and entertaining in conversation. My grandfather thought the Doctor's interest in ornithology was probably due to a tendency to tuberculosis and the necessity for an out-door life." The truth is Wheaton's interest in the woods and living things found there dates from earliest childhood. After the father's death his mother often administered rebukes to her son in written form. A letter dated July 30, 1853, now in the possession of Dr. Wheaton's son, Robert, says: "John, I told you yesterday morning to do some work and you said it was too wet and asked to go into the woods. I gave you leave with the promise that you would return soon and stay in the house in the afternoon and read. You did not come home till three o'clock. Is this the way to obey and comfort your mother? If you do not become a good boy you will not go to heaven and see your father." This is but one of many rebukes given for roaming the woods and meadows. The love and call of tangible, glorious woods; trees topped with birds bursting forth in song; butterflies and bees flying and droning about; unweeded gardens at his feet were inviting realities with which an unknown heaven could not compete. It is well that youth does not take too seriously the concern of elders.

Dr. Loving paid tribute to the skill and confidence he had in his student by calling Dr. Wheaton to attend Mrs. Loving during a long and serious illness. The service rendered was one of love. Dr. Loving expressed his appreciation of this service by presenting Dr. Wheaton with a fine Kentucky riding horse to aid him in his service to others. Until then Dr. Wheaton had made all his calls on foot or street car.

Excellent physician that Dr. Wheaton was, it was as an ornithologist that he obtained lasting fame. It is not easy to understand how a man so conscientious and successful in a profession, also found time for serious scientific work the result of which is of such quality and value that his name stands foremost as a pioneer in Ohio orni-

thology. Splendid work had been done by Professor Jared P. Kirtland (1793-1877), who in 1838 prepared a catalogue of Ohio birds naming 222 species. He was widely known as a naturalist, as a horticulturist, and florist. By profession he was an excellent and beloved physician.

Wheaton's catalogue of Birds of Ohio (Agricultural Report for 1860, published in 1861, pp. 359-380) was prepared with the assistance of Messrs. John Kirkpatrick, R. W. Winslow, and Dr. J. P. Kirtland. In this catalogue of 271 birds the classification of Professor Baird, in Birds of North America, is adopted. Of this catalogue Wheaton says: "In the year 1838 Prof. Kirtland, then State Zoologist and Botanist, prepared a catalogue of Ohio Birds which was considered very nearly complete. Since then . . . new species have been discovered and others added to our fauna. Some which were then rare are now common. Many then common have now retired from our limits or are very rare." He also states that due to the physical features of Ohio the state has a larger proportion of resident birds than the surrounding states. In referring to the game law passed by the Ohio Legislature in 1857 he says: "The quail has become as numerous as ever." The legislature of 1860 wished to extend the law to protect more species. The discussion regarding such extension is enlightening and interesting. I quote the following: "The passenger pigeon needs no protection." "The yellow-hammer or flicker may be included and receive protection though its eatable qualities certainly do not rank very high." "The meadow-lark . . . though not strictly a game bird, is yet quite eatable."

Of Wheaton's "The Food of Birds as Related to Agriculture" (Twenty-ninth Ann. Rep. Ohio State Board of Agric. for 1874, 1875, pp. 561-578) Elliott Coues (Birds of Colorado Valley, 1878, p. 716) says: "This is, in effect, a corrected and completed list of the birds of Ohio, briefly annotated, and with general food-regimen of each family given; being a well conceived essay of much practical utility."

Wheaton's principal and most valued work is a Report on the Birds of Ohio, published in 1882 (Geological Survey of Ohio, Vol. 4, Zoology and Botany, pp. 187-628). This work is reviewed by that peerless critic, Elliott Coues, whose words place upon a writing a stamp that makes it current and unquestionable as to quality. Dr. Coues says: "This long-deferred work reaches us at length in the form of a treatise on the ornithology of the State so extensive and so systematic that the time [six years] its preparation has occupied seems justified if not absolutely required. . . . Dr. Wheaton's report must at once take place at the head of State Faunas, so far as ornithology is con-

cerned. It represents a large amount of original research, extending over nearly a decade, . . . applied to the construction of a systematic treatise which possesses the necessary qualities of a good working handbook of the subject. . . . Ohioans have here . . . a correct history and description of their 300 birds, systematically arranged and classified . . . a work of that useful kind called 'a manual' and bearing the weight of competent authority. Since the death of Dr. Kirtland, we doubt that any one is better entitled to speak of Ohioan birds than Dr. Wheaton, who appears to have himself collected, in the vicinity of Columbus, more than two-thirds of the species he treats,, and to have admitted none that he has not personally identified, except on unimpeachable authority." Quoting directly from Wheaton, Coues continues: "The descriptions of species are almost without exception or alteration from Dr. Elliott Coues' Key to North American Birds. . . . The nomenclature adopted is that of Dr. Coues in his Check List of North American Birds (1874) with such modifications as changes, made since its publication, require. . . . Following the description I give, as briefly as possible, an account of its general and breeding habits, together with such biographical observations as seem to me interesting or valuable . . . making a total of 298 species and varieties. . . . In the appendix I have inserted a list of birds, with the dates of their appearance and disappearance, as observed by me in this vicinity. . . . A list of [101] birds identified by me in my garden in this [Columbus] city." Dr. Coues continues his review: ". . . This volume of some 450 pages is no slight nor uncertain addition to our ornithological literature. It is easily first in its special field, and takes its permanent place among the more comprehensive treatises on North American birds . . . [since] the text is well written, and possesses the attraction of being mostly new and original. . . . Dr. Wheaton is one of the pioneers in Ohio ornithology, his publications upon the subject extending over a period of more than twenty years." (The Bull. Nutt. Ornith. Club, VIII, 1883, 110-112).

It is more than fifty years since The Birds of Ohio was published. A letter from his son, Robert Wheaton (August, 1936), says: "My father's ornithological collection has been in the Ohio State Museum since a year or two after his death. The collection consists entirely of bird skins, there being no mounted specimens among them. What is left of his butterfly collection is in our home. His collection of shells is also in the museum. Not long ago the curator of Natural History in the Ohio State Museum advised me that the Smithsonian Institution in Washington still considers my father's work their standard reference."

E. S. Thomas, Curator of Natural History, Ohio State Museum states [October 6, 1936]: "Dr. J. M. Wheaton collection shows 606 museum skins of birds."

The Wheaton Club of Columbus was organized at the Ohio State University in his honor in 1921. Some interesting contributions to ornithology have come from this organization.

John Maynard Wheaton was one of the founders of the American Ornithologists Union and his death was the first among its active members. He was an occasional contributor to current ornithological literature. Dr. C. Hart Merriam, who knew Wheaton in his profession, in his scientific work, and as a friend, in a letter received in February, 1937, says: "Dr. J. M. Wheaton, of Columbus, Ohio, was not only one of my dearest friends, but an ornithologist of high standing, whose loss was a severe blow to American ornithology. In 1874 when I was in charge of the American Ornithologists' Union's Committee on Bird Migration, Dr. Wheaton served as Superintendent of the Middle-Eastern District, including Ohio. Dr. Wheaton was an unusually competent observer, possessed of a bright eye and a keen brain, a man whose death was a great loss to ornithology as well as to his many patients and other friends."

He lived his entire life in Columbus, Ohio, where he was an esteemed citizen. The death of this beloved physician was deeply mourned by those who called him "our doctor". Friends who had talked and walked with him through woods and meadows, by lakes and streams, keenly felt the loss of his presence. The essence of his life has enriched the science of natural history and in the field of ornithology he lives for his valued contribution.

Writings of J. M. Wheaton

1861. Wheaton, J. M. Bird Notes. Field Notes [Agricultural Newspaper, Columbus, Ohio]. I, 1861, 65.
Note on the distribution of the distribution of the Pileated Woodpecker, Whip-poor-will, Nighthawk, and Shore Lark.

1861. Wheaton, J. M. Rare Birds. Field Notes. I, 1861, 153.
Notes on the capture at Columbus, in May, of *Porzana carolina*, *Rallus virginianus*, *Guiraca ludoviciana*, *Ardetta exilis*, *Gallinula galeata*, and *Chondestes grammaca*. New species, 1.

1861. Wheaton, J. M. Ornithological Inquiries. Field Notes. I, 1861, 152.
Suggestions as to the proper identification of *L. occidentalis*, with interesting notes upon the breeding habits of the Florida Gallinule, and upon *Ardetta exilis*, and *Botaurus lentiginosus*.

1861. Wheaton, J. M. Catalogue of Birds of Ohio. Ohio Agricultural Report for 1860 (1861). Pp. 359-380. Prepared with the assistance of Messrs. John Kirkpatrick, R. K. Winslow, and Dr. J. P. Kirtland.
Two hundred and eighty-five species are given with annotations.

1861. Wheaton, J. M. Catalogue of the Birds of Ohio. Reprinted from the Ohio Agricultural Report for 1860. Pp. 1-21.
A reprint of the preceding title, repaged, and with its addenda distributed in place. Three species are added to the list of probabilities.

1874. Wheaton, J. M. Notes Found in Coues' Birds of the Northwest, 1874, pp. 233-234.
In these notes credited to Dr. Wheaton are annotations on the Olive-backed Thrush, Blue Warbler, Yellow-throated Warbler, Cedar Bird, Brotherly-Love Vireo, Loggerhead Shrike, Song Sparrow, Lark Finch, ,Nighthawk, and Chimney Swift.

1875. Wheaton, J. M. The Food of Birds as Related to Agriculture. Ohio Agricultural Report for 1874 (1875). Pp. 561-578. (September, 1875). Also a reprint, repaged but otherwise unchanged.
"This is in effect a corrected and completed list of the birds of Ohio, briefly annotated, and with the general food regimen of each family given; being a well-conceived essay of much practical utility." From Coues, Bibliographical Appendix, Birds of the Colorado Valley, 1878. This edition contains 288 species with six additional varieties.

1877. Wheaton,, J. M. The Ruff and Purple Gallinule in Ohio. Bull. Nutt. Ornith. Club, II, 1877, p. 83.
First authentic record of the Ruff and Purple Gallinule in Ohio.

1879. Wheaton, J. M. Kirtland's Warbler again in Ohio. Bull. Nutt. Ornith. Club, IV, 1879, p. 58.
A male and female *D. kirtlandi* taken at Rockport, Cuyahoga County, Ohio, in 1878.

1879. Wheaton, J. M. Occurrence of Birds Rare to the Vicinity of Columbus, O. Bull. Nutt. Ornith. Club, IV, 1879, p. 62.
Reports the Red Crossbill (in June), Swallow-tailed Kite, Barn Owl, and Pinnated Grouse.

1881. Wheaton, J. M. The Ruff. Cinc. Soc. Nat. Hist., Vol. 4, 1881, p. 341.

1882. Wheaton, J. M. Report on the Birds of Ohio. Report. Geol. Survey, Ohio, Vol. IV, Part I, 1882, pp. 189-628.
This list includes 298 species.

Berkeley, Calif.

WINTER NESTING AND WINTER FOOD OF THE BARN OWL IN SOUTH CAROLINA

BY CLARENCE COTTAM AND A. L. NELSON

The Barn Owl (*Tyto a. pratincola*) is a widely distributed species occurring at least casually in all sections of the United States. It is usually a permanent resident wherever it becomes established, although records indicate that it is partially migratory. The Biological Survey's banding and migration files contain a number of records of individual birds banded in New Jersey and Pennsylvania that were subsequently collected in South Carolina and Georgia. While it is known to be an erratic nester, most nidification records are for the spring months. Several records of fall and winter nests, however, have been published and a number of these are for South Carolina. Audubon in his "Ornithological Biography" (Vol. 2, pp. 404-405) discusses the finding of a nest of three young in October near Charleston, and estimated that the eggs from which the young had been hatched must have been laid by September 15. The young in this instance had been fed throughout their nest life exclusively upon small mammals, principally cotton rats. Arthur T. Wayne, in the *Auk* (Vol. 25, 1908, p. 21) reported finding a pair of these owls nesting in early winter, November 18, 1906, in an old mill on the banks of the Cooper River. The following year on the same site a nesting pair had a clutch of six eggs by September 19. Wayne advanced the theory that the birds may breed in South Carolina in the fall because at this season their natural food supplies are at a maximum. Rhett Chamberlain, (*Auk*, Vol. 28, 1911, p. 112) gives a record of another set of four eggs near Charleston in September. Other State records cover occurrences of nesting in the spring, which is considered the normal breeding season.

As further evidence of the winter nesting habit of Barn Owls an interesting recent record of off-season breeding may be cited from one of the Federal Migratory Bird Refuges. Reference is made to the Cape Romain Refuge located not far from McClellanville, South Carolina. In October, 1936, under the supervision of Refuge Superintendent Andrew H. DuPre, construction work on a 45-foot steel observation tower for this area was begun. The tower site was located in a salt marsh some four miles east of McClellanville and was situated on a mud flat in an almost pure stand of salt-marsh cordgrass (*Spartina alterniflora*) that is usually twice daily covered by high tide. The nearest tree, and in fact the nearest dry land, is approximately two and one-half miles distant. The habitat is one best suited to such birds as

the Clapper Rail, various ducks, and perhaps Seaside Sparrows. Certainly one would not look for a Barn Owl in such a situation.

Late in October when the framework of the tower was erected and the floor about half completed, emergency work on the refuge caused interruption of building operations and prevented completion of the project. When the Superintendent returned with his men to complete the tower a few days later, he discovered that a Barn Owl had taken possession and had begun nesting. To prevent disturbing the bird completion of the tower was delayed. A few subsequent trips by the Superintendent were made and at each visit the owl would leave and alight on the nearby mud flat in the midst of the plant growth—a habit characteristic of Short-eared Owls but so far as the writers are aware, an uncommon trait for Barn Owls. A nearby temporary wharf, not more than sixty yards away, which afforded landing from a channel or "natural", contained several upright poles that might have been used for roosting, yet the bird preferred to alight in the marsh within a hundred yards of the tower.

The nest was placed in the northeast corner of the tower and was a very crude affair consisting of a few feathers from the birds' bodies and by the time incubation was completed, it was well lined and surrounded with broken down pellet debris and bone fragments of its larger prey. Nine eggs completed the clutch. At a visit to the nest on November 17, when Mr. DuPre knew that incubation must be nearing completion, it was found that calamity had befallen the set. Seven of the eggs had hatched and the two remaining were well pipped, yet evidence indicated that the parent bird had not been in attendance for perhaps twenty-four hours. As a consequence, the larger and more vigorous young had crawled out of the nest and had fallen to the stairway or ground and all had starved or frozen to death. The two preceding nights had been unusually cold.

But one adult bird was seen near the nest at a time and it is doubtful that the male assisted in the duties of incubation. Whether the female met death while searching for food or whether the urge of migration became stronger than the parental instinct is not known. At any rate, she failed to return to her brood and was not seen afterwards. It should be pointed out that this is the only owl reported for the refuge during the past three years.

To obtain data on the food secured by the bird in this unusual locality, twenty-one whole pellets were collected and examined in the Food Habits Laboratory of the Biological Survey in Washington, D. C. The results indicate that marsh-frequenting birds were taken in greater

numbers than is usually the case. Normally this species subsists almost entirely upon small rodents.

The following table gives the results of the laboratory pellet analyses:

TABLE 1. Food Remains Found in Twenty-one Nest Pellets of the Barn Owl Collected on Cape Romain Migratory Bird Refuge near McClellanville, South Carolina, November 30, 1936.

Pellet No.	Food Items	Pellet No.	Food Items
1	1 rice rat 1 seaside sparrow	10	1 undetermined bird about the size of a clapper rail
2	1 rice rat	11	3 rice rats
3	1 rice rat 1 seaside sparrow	12	1 meadow mouse
4	1 virginia rail 1 rice rat	13	3 rice rats
5	1 meadow mouse 1 seaside sparrow	14	1 meadow mouse 1 rice rat
6	1 seaside sparrow 1 undetermined bird—size of clapper rail	15	1 seaside sparrow
7	1 undetermined bird, probably a rail	16	1 meadow mouse
8	1 rice rat	17	1 meadow mouse
9	2 rice rats	18	2 rice rats
		19	1 meadow mouse
		20	1 rice rat 1 undetermined rodent
		21	1 meadow mouse

If each pellet represents the indigestible residue of a single meal, it will be noted that for the 21 meals, 17 rice rats, 7 meadow mice, 1 undetermined rodent, 3 birds presumably Clapper Rails, 1 Virginia Rail, and 5 Seaside Sparrows were consumed. Special reference should be made to the occurrence of meadow mice (*Microtus pennsylvanicus*) as standard manuals on mammalogy do not record this species along the coast south of northern North Carolina.

BIOLOGICAL SURVEY,
WASHINGTON, D. C.

HARRIS'S SPARROW IN ITS WINTER RANGE*

BY CHARLES E. HARKINS

This paper presents the results of an investigation of the plumage changes and the behavior of Harris's Sparrow, *Zonotrichia querula* (Nuttall), in its winter range. The study, carried on at Stillwater, Oklahoma, has been a continuation of work done in the same locality during the winter of 1934-35 by Park (1936). Since Stillwater is near the center of the bird's winter range, findings here may be regarded as typical.

Swenk and Stevens (1929), with the aid of several coöperators along the migratory route, thoroughly investigated the general distribution, migration, habitat, food, voice, size, behavior, plumage, and molts of Harris's Sparrow in north central United States. Nice (1931) studied this sparrow in central Oklahoma, her work consisting principally of field observations and a study of four banded birds. The plumage, habitat, song, and behavior were studied. Park (1936) banded birds in the vicinity of Stillwater and studied the behavior of this sparrow in its winter range.

Materials and Methods

The traps used for catching Harris's Sparrow in this vicinity were constructed according to the specifications of Lincoln and Baldwin (1929:18). Two traps, designated A and E, built upon weathered wood frames, were suspended, by wire from branches of trees, three or four feet from the ground. A third trap, C, was placed upon a frame covered by screen wire; which was strewn with dirt, leaves, and sticks in order to represent the ground. The traps were set in places where Harris's Sparrows had been observed in abundance. Trap A at Station A, was set on a tributary of Stillwater Creek about three-fourths mile west of Stillwater in a clump of bushes (Fig. 15). The trap was well sheltered and covered by vines, mostly smilax and wild grape. The second trap (Station C), located on another tributary of Stillwater Creek two and one-eighth miles directly south of Station A, was placed in a thicket containing a few large trees. The third trap (Station E), also on a tributary of Stillwater Creek one mile north and three-fourths mile west of Station A, was well sheltered in a wooded valley with hills to the north and south. Bait consisting of corn, wheat, and smaller grains was spread over the platform inside and outside the traps.

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*Contribution from the Zoological Laboratory of the Oklahoma Agricultural and Mechanical College, prepared under the direction of G. A. Moore.

Field observations began on October 1, 1935, and continued, with frequent visits, until the first arrivals were seen at Station A on October 22 at 5:45 P. M. Accordingly on October 23 a trap was set. On October 24, a trap was placed at Station C and on November 10, another trap was set at E. The one placed at Station E was new and it was feared that it might frighten the birds, but apparently this did not occur because the first eleven Harris's Sparrows were banded here.

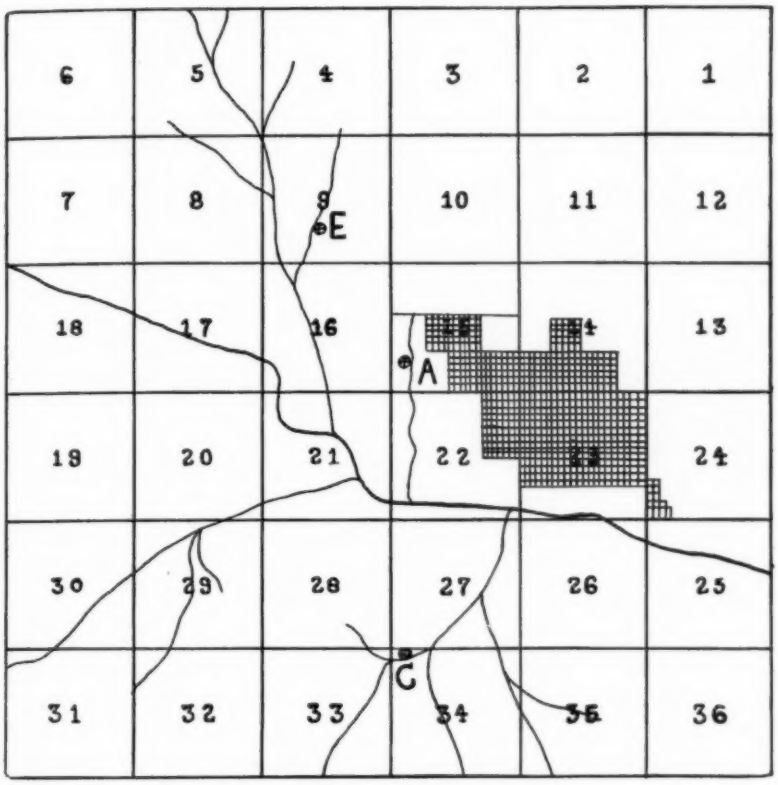

FIG. 15. Map of the region in the vicinity of Stillwater, showing the location of the traps referred to in this paper.

The visits to the traps were made daily a little before nightfall. Care was taken in approaching the traps and in handling the birds to avoid frightening them unduly. Pictures were taken with an Eastman Kodak (116 Brownie), with portrait attachment, at a distance of two feet six inches. Split-ring bands, size 1A, were furnished by the Bureau of Biological Survey, U. S. D. A. These birds were held during banding according to instructions given by Lincoln and Baldwin (1929:90).

Results

The largest numbers were caught in November and April, while February had the fewest. Doubtless the birds were traveling southward in November and returning to their summer range in April. February, March, and the first few days of April yielded very few new birds. Low temperatures and rainy weather account for the spring return being delayed until the middle and latter part of April when more clement weather prevailed. December, being mild, ran high in "returns"; only twelve new sparrows were caught but thirty-eight different individuals returned. January yielded a small number of new birds and a decrease in the number of returns. February showed a decline in new birds and returns. March gained slightly in new birds and greatly in returns. April showed a wave of migration higher than any of the other months. Harris's Sparrows banded during the season 1935-36 were as follows:

	Adult	Immature
November	17	13
December	6	6
January	10	6
February	1	4
March	9	2
April	18	3
Total	61	34

The limited data collected indicate that Harris's Sparrow follows the same migratory route every year since five birds banded by Park in 1934-35 returned in 1935-36 to their original banding station. No. 169108 arrived at Station A on November 20, 1934, and apparently stayed in that locality until December 7, 1934, since it was caught seven times during that period. On November 21, 1935, this same bird arrived at Station A with no change in plumage. No. 169107, caught at Station A on November 20, 1934, returned once between that date and December 8, 1934, and returned again to Station A a year later, on December 9, 1935, and again on January 20, 1936. No. 169386, caught at Station A on April 6, 1935, returned to the same place on December 9, 1935. No. 169254, caught at Station C on March 5, 1935, returned to that station on January 25, 1936. No. 169170, banded at Station C on February 16, 1935, returned six times that year and again on January 29, 1936.

It is evident that small groups may remain intact for considerable time and follow the same route in the spring as in the fall. Thirteen groups of two birds each returned more than two times. Six groups of more than two birds each returned more than two times.

The length of time that the birds remain in a locality, in the winter range, varies. Judging from the number of times caught, some may stay for only a short time, while others with the "trap habit", remain for a longer period. No. 169338, caught on November 20, 1935, returned occasionally throughout the winter and spring, excluding January, until April 23. It was caught fifteen times. From November 21 until December 8, 1935, No. 169343 was caught seven times, and returned again on February 19, 1936. No. 169349 stayed approximately one month, from November 21 to December 18, 1935, and was caught five times. The average time for each in a particular locality is about ten days and the extremes are about one day and three months.

A few interesting observations follow: No. 169330, caught at Station A, and released in Stillwater on November 18, 1935, returned in a few days. This same bird, evidently with the "trap habit", when again released in town returned to the trap in two days. No. 169338 was habitually returning to Station E and having been caught eleven times was released at Station A on March 9 and returned to Station E on March 12. No. 169349 had been caught four times at Station A and when liberated December 17, 1935, returned immediately to the trap and started eating grain. It was carried to Station E and released, as further test, but the next day the bird was in the trap at Station A. It is interesting to note that birds caught at one station and freed at another were never caught at the latter. In fact, they either returned to the station where originally caught or disappeared. Since traps C and E were within a radius of two miles of Station A, and no bird was caught at more than one trap, the stopping places of each bird must be well localized. They do not appear to roam extensively while in a particular locality.

Immature birds, upon their arrival in the fall, were somewhat variable in coloration. The crowns were often black centrally with margins of gray or mingled black and white. The cheeks were gray-buff, the postauricular spots varied from light brown to brown, the chins and throats were white somewhat mottled with black, while the breasts were mottled black and white.

The adults in the fall had black crowns (sometimes varied by lateral margins of a few white and buffy feathers), gray-buff cheeks, and brown postauricular spots. The black of the throats and chins varied in intensity and the chests, though much blacker than in immature birds, were mottled. These markings remained, as typical, until the spring molt, first signs of which were observed March 12, 1936. During the next two weeks signs of molting became more and more notice-

able, and birds that remained away from the trap for several days returned changed. The birds did not all molt at one time for No. 106323, caught March 12, 16, and 17 did not start until March 20. Likewise No. 169334, first caught on November 19, 1935, and later on March 1 and 16, showed no signs of molting until again caught on March 28. No. 169338 (adult) not molting on March 1 and April 16, when caught on April 22 was molting, for the cheeks had changed from buffy to a solid gray and the black was more extensive and intense. No. 169357 had not molted when caught on February 19, but on March 14, change was evident. No. 169375 (adult) first caught December 16, 1935, when caught again March 16, 1936, had already undergone a partial molt changing the crown from black with gray bars to solid black to the nape. The chin was already black, the neck and upper breast had turned to solid glossy black while the cheeks were still brownish gray. This bird was not caught again.

Pictures taken before and after molting show the changed appearance of the chin, throat, and chest. No. 106320, taken on March 6, 1936, had not started to molt. The crown was barred black, white, and brown, with black dominant; cheeks gray-buff; postauricular spots light brown; chin black; throat black and white; chest black with brown and white spots. On April 22, 1936, this bird returned and had changed to the typical black hood, gray cheeks, and dark brown postauricular spots.

As a contrast, No. 169338 arrived at Station E on November 20, 1935, and constantly returned every few days. It was plainly an adult but had one white spot in the center of the crown. The cheeks were gray-buff, the postauricular spots brown, the chin black, the throat black with white laterally, and the chest mottled black and white. Taken again on April 6, it showed no great change, but on April 22 there was a distinct change in the markings. The white crown spot was gone and the bird had donned its black hood.

No. 106323 first taken on March 12, 1936, at Station A, consistently returned and on March 20 was molting. At the time the first picture was taken the crown was barred black, gray, and buff. The cheek was grayish-buff and the postauricular spot brown. The chin had just a streak of black beneath the beak which extended in a fine line on each side of the white throat. The chest was mottled black and white. On March 31, the throat was blacker and the cheek was becoming somewhat gray. April 2 the crown was black in the center and laterally barred black, gray, and buff. The cheeks, chin, and postauricular spots had not changed; the chin was black, and the throat had

a black central stripe reaching from the chin to the chest. On each side of the throat, the feathers were white. This bird had been classified as immature.

An adult bird, No. 169357, arrived at Station E on November 27, 1935. The crown was black in front and barred posteriad with black and gray. The cheek was gray-buff; postauricular spot brown; chin, throat, and chest mottled black and white. On March 14, the bird had its black hood and the cheeks and postauricular spots were unchanged.

No. 106310 arrived at Station C on January 27, 1936. The chin, throat, and chest were mottled black and gray; the crown was brownish-gray, the cheek grayish-buff, and the postauricular spot brown. On April 6, it returned to the same station with crown, cheek, and postauricular spot unchanged, the chin and throat black, and the chest mottled black and gray.

Many birds were caught for the first time after the molting period was over. In fact, all birds caught after April 17, 1936, except the immature individuals, had black hoods, gray cheeks, dark brown postauricular spots, and mottled black and white chests.

Nice (1931) states that about one-tenth to one-twentieth of the birds have the black hoods in the autumn but all assume it by late April. In this trapping locality, the autumn records show that 63 per cent in 1934 and 40 per cent in 1935 of the birds trapped were immature (no black hood). Not all of the birds had assumed the black hood in late April, since in April, 1935, only 54 per cent had black hoods and in April, 1936, 82 per cent. (See table).

Although Harris's Sparrows did not seem to be extremely frightened by the operator opening the traps, they did appear to be frightened when the traps were visited by some disturbants. On January 22, 1936, when the trap was visited at Station E, no Harris's Sparrows were caught but a number of them were noticed in the bushes. Near the trap approximately fifty boys were playing ball, taking pictures of the trap, and tramping down the bushes. No more birds were caught here until February 19.

March 20, 1936, a large cat was found at Station A and the trap had been somewhat battered. There were two Harris's Sparrows in the inner chamber, frightened but otherwise unharmed. No birds returned to this trap until March 31.

On April 1, 1936, a squirrel was taken from the trap at Station E. Blood, feathers, and hair were in the inner chamber. Although the trap was thoroughly cleaned no birds returned until April 17.

The presence of such disturbants must leave a marked impression at the trap. The cat and squirrel may have frightened the birds away and, by their tampering with the traps and feed, may have induced fear. On April 28, 1936, No. 106332 was killed and eaten by an unknown animal in the trap at Station E. Before this time many birds had been caught here but no more were seen or taken at this trap after that date.

Conclusions

1. Harris's Sparrows, in their migration, follow the same route year after year. In following this route, they stop at certain points for food, and linger for from one to thirty days (average ten). Banded returns indicate that the birds stop at the same places in the spring as in the fall.

2. Harris's Sparrows enter the traps often in groups of two or three and these groups often return to the traps together.

3. The molting period begins about the middle of March and continues until the middle of April. The molt is accompanied by a change in plumage typical to the age of the individual bird. The outstanding changes occur in the regions of the crown, cheeks, postauricular spots, chin, throat, and chest. The adult changes were: Cheeks gray-buff to a uniform gray or slate gray; postauricular spots light brown to dark brown; crown, chin, and throat to a uniform black hood. The immature birds remained the same in the cheeks and postauricular spots but darkened somewhat in the other parts mentioned. As a whole, in the spring, the immature Harris's Sparrow is about 50 per cent darker on the crown, chin, throat, and chest than in the fall.

4. Harris's Sparrow may be frightened away from a given locality for a period of several days by some unusual commotion.

5. Harris's Sparrow shows a marked homing instinct. While stopping in a particular locality, they do not roam far from that vicinity.

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EDITORIAL

The excellent *Quarterly Review of Biology* runs a very excellent book review department, which we read very carefully and regularly. We have often enjoyed the devastating appraisal of some book—and sometimes deprecated it. The current number carries an anonymous review (they are all anonymous, for that matter) of some bird book (which we have neither seen nor heard of previously). And the only thing about the review which caught our attention was the reviewer's impatience with verse. We must make the matter clear with the following quotation: "To the distress of the reviewer the author frequently deserts prose for verse. This is so often true of books of this type that we, as hard-boiled cynics, are tempted to suggest that some bright young person prepare a doctorate on the stimulus given poetry by ornithology (or *vice versa*)."

This at once forced us to recall that our leading article in this issue starts off with a verse. But, we reflected that Dr. Bissonnette's learned researches and contributions to experimental ornithology would protect him from any suspicion of languid sentimentality. It then happened that on the same day we opened the current issue of *Science* (Sept. 3, 1937) and found the leading article to be by Sir Edward B. Poulton, of the University of Oxford, and president of the British Association for the Advancement of Science, and which article contained two verse quotations. Then, without a change of date, we turned the pages of the same September *Quarterly Review*, and found the paper on the seventeen year cicada by the veteran and distinguished Professor E. A. Andrews, of Johns Hopkins University, on the first page of which and on the last page of which short verses are interpolated.

We are thus guided to the conclusion that a slight addiction to verse is not incompatible with scientific standing, even though it may be indicative of some familiarity with poetical literature and some time spent browsing therein—and hence away from the grindstone of science.

And as long as we are so close to the subject we may as well say that we have never felt very great admiration for anonymous reviews or writings of any kind—especially those with sarcastic and walloping inclinations. We can't help wondering how much of it is braggadocio, and how much punishment the bully could take before the tears would come.

GENERAL NOTES

Conducted by O. A. Stevens

Lapland Longspurs in Kentucky.—I have observed hundreds of Lapland Longspurs this winter (1936-1937) in Hopkins and McCracken Counties, Kentucky. One was collected.—Raymond J. Fleetwood, *Paducah, Ky.*

The Starling in Clay County, South Dakota.—Reports of the Starling in southeastern South Dakota are as yet rare; therefore, the writer would like to add a record for Clay County. On March 28, 1937, I saw a pair of Starlings on the western edge of the town of Vermillion, and it is probable that the birds will breed in that vicinity.—Wm. Youngworth, *Sioux City, Iowa.*

Yellow Rail in Ohio.—On April 18, 1937, the writer flushed a Yellow Rail (*Coturnicops noveboracensis*) in a wet, grassy field near Cleveland, Ohio. The chicken-like bill and yellow underparts were noted as the bird descended into the grass a few yards beyond the spot where it was first flushed. On being approached the bird took flight again, displaying the characteristic white wing patches. It flew about thirty yards and dropped into a blackberry patch. So far as I know, this is the second record for this rare species in the Cleveland region.—Ralph O'Reilly, Jr., *Cleveland Heights, Ohio.*

Gull Records for Lake Erie.—More than the usual number of gulls remained along the shores of Lake Erie during the past winter (1936-37). Here in Cleveland a few Bonaparte's Gulls were noted among the hundreds of Herring Gulls and Ring-billed Gulls. At Ashtabula harbor a Glaucous Gull was seen on December 27 by a party including the writer. The bird appeared to be a second-year bird, as it had not yet acquired the spotless plumage and yellow bill of the adult. At the same place on January 30 an adult Iceland Gull was noted as it flew by at a distance of only about thirty yards. At Presque Isle, Erie, Pennsylvnia, on February 20 and 21, a Great Black-backed Gull was seen in the bay. At the same place we saw a flock of twenty-one Common Redpolls. Both species were observed in good light at short range.—M. B. Skaggs, *Cleveland, Ohio.*

Pine Siskins in Western Maryland.—On July 1, 1937, a number of Pine Siskins (*Spinus pinus pinus*), some of them young birds of the season, were noted in Swallow Falls State Forest, along the Youghiogheny River in Garrett County, Maryland. The birds were feeding and calling in hemlock trees, and it seems reasonable to suppose that they may have bred locally. Individuals of this species were again noted on July 3 by Mr. M. Graham Netting, of the Carnegie Museum, Pittsburgh. The forest here is of nearly pure virgin Canada hemlock (*Tsuga canadensis*), and many Canada, Black-throated Blue, Blackburnian, Magnolia, and Black-throated Green Warblers, Juncos, Red-breasted Nuthatches, and Mountain Vireos nest locally. Siskins are rarely observed in summer on the Allegheny tableland, a region embracing parts of Pennsylvania, Maryland, and West Virginia.—Maurice Brooks, *West Virginia University, Morgantown, W. Va.*

Unusual Sparrow Records from Arizona.—A single Swamp Sparrow (*Melospiza georgiana*) was seen by the writer on December 19, 1936, at Tuba City, on the western side of the Navajo Indian Reservation in Arizona. It was closely observed as it perched in a small willow; its characteristic note helped to identify

it. But one other Arizona record exists, that of a specimen taken December 22, 1915, near Tucson by Howell (*Condor*, 18, 1916, p. 213).

On February 19, 1937, a Harris's Sparrow (*Zonotrichia querula*) was observed at Moenave, a few miles west of Tuba City, in company with a great number of Gambel's Sparrows (*Zonotrichia leucophrys gambeli*). The bird was judged to be an immature male. It also is the second record of its species for the state, the other being on March 15, 1913, at Sacaton by Gilman (*Auk*, 31, 1914, p. 403). It might be pointed out that both previous records are for the southern part of the state.

Song Sparrows (*Melospiza melodia* subsp. *fallax?*) were common at Moenave and Tuba City during the winter months, leaving during the early part of March. There are no previous Song Sparrow records for the northern part of the state, aside from one seen by the writer on September 15, 1936, at Teec-Nos-Pas in the very northeastern corner of Arizona, also on the Navajo Reservation.—Gale Monson, *Gallup, N. M.*

The Carolina Wren in Wisconsin.—On March 17, 1937, a group from the Game Management Division visited the E. H. Fabrice Farms in southeastern Wisconsin, Lafayette Township, Walworth County. The main farm, which is one of the wild life demonstration and experimental areas under direction of the University, has 160 acres of unpastured and undisturbed woodlot.

A number of birds were seen, but the outstanding record, worthy of note, was the Carolina Wren (*Thryothorus l. ludovicianus*). This bird was heard by the entire group of eight persons, including professor Aldo Leopold and Leonard W. Wing, and seen by Harry Anderson and Arthur Hawkins, of the Game Management Division, and Richard H. Pough, of the National Association of Audubon Societies. The bird was found in an oak-maple woods bordering Sugar Creek. Several small spring flows and hillside bogs are in the vicinity in which the wren was seen. During the week of April 25-30, 1937, I saw the wren on numerous occasions, and had it under observation with binoculars.

In the spring of 1936 I saw a Carolina Wren at the same locality on two occasions, April 26 and May 10; both times I heard the song. Kumlien and Hollister in "The Birds of Wisconsin" (1903) considered the species a "rare straggler to Wisconsin". Roberts (1934) states: "It is spreading northward and has reached southern Minnesota in limited numbers."—Douglas E. Wade, *Game Management Division, University of Wisconsin, Madison, Wis.*

Some Interesting Killdeers.—In May, 1935, the spring meeting of the Indiana Academy of Science was held at Mt. Vernon, Indiana, on the Ohio River. One of the members, Glenn A. Black, an enterprising archaeologist, with others on May 12, visited some of the pre-historic Indian locations of the vicinity. At a village site some three miles east of Mt. Vernon they found a burial up-turned by the plow. The smaller bones had been rearranged to form a nest. It contained three eggs of a Killdeer as shown in the accompanying photograph. (Fig. 16). I have enjoyed the picture which was presented to me by Mr. Black and desire to share it with other bird students because of its unusual character.

In this connection I wish to speak of an experience of my own. Some two years before the above find, also in May, I found among some brick bats and other such material that had been hauled to fill a low place in the barnyard of my farm near Kokomo, Indiana, four Killdeer eggs. Notwithstanding the fact that

horses, cows, sheep, and hogs had free run over that yard, the birds hatched all their eggs and presumably the young escaped from the animals of the barnyard.—Amos W. Butler, *Indianapolis, Ind.*

Wayne's Clapper Rail Carries Its Young.—In view of the recent discussion in the Wilson Bulletin concerning the habit of birds to carry the young, the writer presents the following case. Many observers have reported an adult carrying young between the legs. It has been reported of the American Woodcock, European Woodcock, Spotted Sandpiper, and Eastern Willet. Gayle Pickwell has written of a Killdeer's nest that was on a shed fifty feet above the ground, and

Fig. 16. Photograph of the Killdeer's nest referred to in Dr. Butler's note.

that the young were found on the ground near the shed while still but feeble walkers. In what manner the old ones had transferred the young was not observed. All these accounts may be found in Bent's Life Histories, in the two volumes devoted to the shore birds. The account of the Eastern Willet is quoted from Wayne's Birds of South Carolina, where he told of finding a nest which contained one newly hatched bird and three eggs ready to hatch. He stayed nearby until all were hatched, and the parent bird carried the young off to some distance, *one by one* until all were removed. Certainly this seems like purposeful action.

Outside the shore bird group Bent quotes an account by Verdi Burtch of a Virginia Rail carrying a young bird back to the nest in her bill. E. Burnham Chamberlain, Curator of the Science Department of the Charleston Museum, has given permission to write down a hitherto unpublished account of Wayne's Clapper

Rail carrying young. It seems that he, with several others, was at Procher's Bluff, South Carolina, during a time of high tide. As they were watching young rails drifting by on the usual drift trash, he noticed an adult rail swimming with something in its bill. Through the binoculars he could see that the bird was carrying a young chick in such a manner that its head was under water. As he watched she stopped, shifted the burden so the young would not drown, swam to the raft of drift, dumped the chick onto it, and clambered up herself.

When one considers the reputation of the observers, the fact that the behavior has been seen in several species, and the number of times it has been reported, it is hard to escape the conclusion that this is a well developed and *purposeful* method of removing the very young bird from a zone of danger. Yet, with the knowledge that the intelligence in the shore bird group is not on a very high plane, I wish someone might furnish a better explanation of the phenomenon and its origin. That it exists we can not well doubt, nor can we well believe it accidental when repeated time after time.—Ivan R. Tomkins, *U. S. Dredge Welatka, Savannah, Ga.*

Melanism in the American Rough-legged Hawk.—The winter of 1936-37 in southeastern South Dakota was one of unusually deep snow. Highways were blocked for days and the prairies were covered early with a blanket of snow that ever increased in depth as the season advanced. The American Rough-legged Hawk (*Buteo lagopus s. johannis*) was abundant, probably forced south in more than usual numbers by the deep snow and severe blizzards which likely made it difficult to procure sufficient food in its northern range.

As the roads were cleared of snow after each new storm, large flocks of Horned Larks (*Otocoris alpestris* subsp.), Lapland Longspurs (*Calcarius lapponicus*), and Ring-necked Pheasants (*Phasianus colchicus torquatus*) were attracted to the graveled highways. Many of these birds were killed each day by the passing cars and furnished a continual banquet for the Crows (*Corvus brachyrhynchos*), in which they were quite frequently joined by the Rough-legged Hawks.

I spent five days a week all winter long traveling this territory and I doubt if a single day passed that I did not see at least one Rough-legged Hawk. Usually I saw many each day and I was especially interested in their great variety of plumage, which ranges from the pure black that give the "Rough-leg" the name of "Black Hawk" throughout the middlewest, to birds of such light plumage that they might easily be mistaken for the Ferruginous Rough-leg (*Buteo regalis*) by the incautious observer. Melanism in the American Rough-legged Hawk is so common as to excite little interest under ordinary circumstances and I had given this phase no more than ordinary attention until an incident occurred which brought it to my notice more forcefully.

On January 29, 1937, in McCook County, south of Montrose, South Dakota, while driving along the highway I noticed two large hawks some distance ahead of me. One of them was perched on a telephone pole and the other had lit in the snow near by. I was able to drive within twenty yards of them and take out my glasses before they took wing. They were identical, no single feature of either size or plumage differed in any respect. Both hawks were black except the under surface of the distal third of each wing. They took wing and flew across the road in front of me, turned and came back low and almost directly overhead. Their markings were unusual even for the Rough-leg and the fact that they were

alike was, to me, very extraordinary. I made a sketch of the under-surface of this hawk, which is shown in Figure 17A. I had been keeping a list, as was my custom, but had not been keeping the melanistic individuals separate from the regular type, except in one instance. On January 11, 1937, two miles southeast of Kaylor, S. D., I saw my first completely black hawk. This bird was not the glossy black of the crow but was of a dull black or very dark brown. It was entirely without light markings of any kind. It was unsuspicious and allowed me to approach to within a short distance. It was an American Rough-legged Hawk, without question.

I now started keeping a record of this phase and in the short series I was able to make, found that about one bird in five differed in some degree from the normal plumage. I am considering as normal the plumage shown by Walter A. Weber on page 330, Volume I, of "The Birds of Minnesota", by Dr. Thomas S. Roberts. This plumage is shown in Figure 17D.

In the sketches shown here I have copied the outline from Weber and filled in the dark and light areas from the drawings in my notebook made at the time of observation.

The bird shown in Figure 17B was seen on February 4, 1937, two miles north of Alexandria, South Dakota; that of Figure 17C was seen on the same date one quarter mile west of Stanley Corner in McCook County, South Dakota.

Aside from those that are shown here, birds were seen in almost every intermediate degree of light and dark coloring.

The fact that the two hawks seen on January 29 were alike makes me wonder if the dark and light phases might not be inherited. I would be at a loss to know how to explain these identically marked dark hawks unless they were from the same brood.—Bruce F. Stiles, *Sioux City, Iowa.*

The Herring Gull Colony at Bridge Lake, British Columbia.—A description of the most southerly nesting so far located in British Columbia of the Herring Gull (*Larus argentatus smithsonianus*) was published by me in the Condor (XXXVII, July, 1935, pp. 214-215). When this colony was next visited two years later, on June 24, 1935, it was observed that the number of birds had increased from thirty-four adults in 1933 to thirty-eight adults in 1935. This had happened in spite of the fact that less nesting accommodation was available, owing to a rise in the lake levels which had reduced the island's area by one-third.

There were seventeen nests composed chiefly of twigs and moss—one contained a few green poplar leaves, several pieces of green grass, and a twig of Douglas fir with green leaves attached. Ten nests contained eggs (four singles, three of three, and three of two); five contained eggs and downy young (in two cases two eggs and one young; in three cases one egg and one young); two nests were empty.

The stomachs of two downy young contained larvae of a predaceous diving beetle (*Dytiscus* sp.) as the chief item. In one case thirty, in the other eight had been eaten. A few of these larvae, which remained sufficiently whole to be measured, were one and a half to two inches long, and the remainder, represented chiefly by jaws, were thought to be approximately the same size. Unidentified fish remains, beetle fragments, and vegetable debris, including a *Polygonum* seed, were minor items totaling 5 per cent of the contents in each case. The stomach of a third specimen held fragments of several small Salmonidae, 95 per cent,

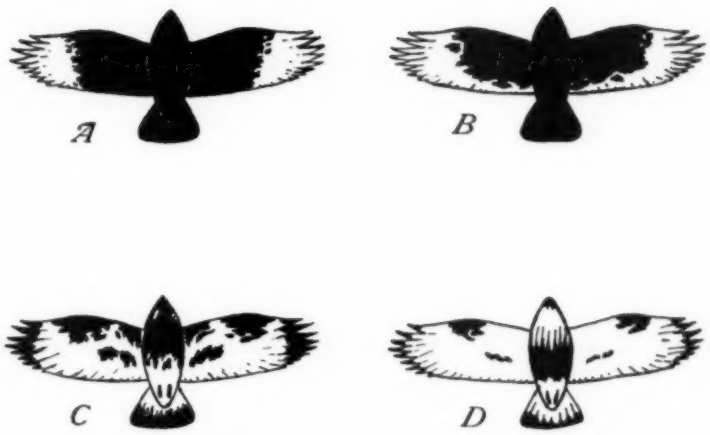

FIG. 17. Diagrams showing the under-surface color patterns of the American Rough-legged Hawks as discussed on the opposite page. A, individual seen on January 29, 1937, in McCook County, S. D. B, individual seen on February 4, 1937, in Hanson County, S. D. C, individual seen on February 4, 1937, in McCook County, S. D. D, normal color pattern as shown by Walter Weber's figure in Robert's "The Birds of Minnesota".

FIG. 18. Photograph showing the Herring Gull colony at Bridge Lake, B. C., mentioned in Mr. Munro's note.

and *Dytiscus* larvae, 5 per cent; a fourth contained parts of a minnow, probably *Richardsonius balteatus*. Two of the four downy young examined had been found dead in the nest. In every case the stomach was well filled.—J. A. MUNRO, *Okanagan Landing, B. C.*

Bird Records from the Allegany State Park.—Two papers have been published on the summer birds of the Allegany State Park, in southwestern New York state, by Mr. Aretas A. Saunders.* His notes on the plumage, nesting, feeding habits, and songs are very interesting reading, betray a tireless eye and ear, and add much knowledge applicable to the same species in other regions.

No one, however, has heretofore recorded the bird life found here in the spring, fall, and winter seasons. It has been my pleasure and privilege to spend three full years in this, the largest of the New York State parks, most of this time in the field. During this time a number of species, twenty-six to be exact, have been seen and are recorded in this paper, for the first time.

The spring is a beautiful and interesting season here. It is at this time that water fowl and shore birds are found in their greatest numbers and variety on and around our two artificial lakes. The largest of these lakes is 120 acres. It is evident from a study of my arrival statistics that there are about five times as many water fowl and shore birds here in the spring as there are in the fall. An interesting fact about the park is that there are no natural lakes or ponds within its borders. This is said to be due to the lack of glacial action in this particular area; in fact the park lies in the only area in the entire state which escaped direct glaciation. The margins of our lakes are almost entirely devoid, as yet, of suitable food plants for water and shore birds. In time, no doubt, the marginal flora will assume a more favorable aspect as desirable plants gain a foothold. Members of the Civilian Conservation Corps, stationed in the park, have performed a real piece of conservation work by gathering thousands of food plants outside the park and planting them in and around the larger of the two local lakes.

Water fowl visit the park as early as March 27, because the ice seldom breaks up and leaves the lakes before the first or second week in April. On this date in 1934, six Hooded Mergansers (*Lophodytes cucullatus*) dropped from a wintry sky. These were followed on the 29th by four scaups (*Nyroca* sp.). On the 30th came the Buffle-heads (*Charitonetta albeola*).

Of course, the above three species visited us more than once during the same season, a fact which applies to most of the other species mentioned in this paper. Ten or fifteen days is about the longest period of time that any species of water fowl remained with us, some species staying but a few hours or a day.

April seems to be the best month to see numbers of water fowl on our lakes. Almost every day brings new arrivals. The following species were seen during this month: Whistling Swan (*Cygnus columbianus*), American Merganser (*Mergus merganser americanus*), Red-breasted Merganser (*Mergus serrator*), Horned Grebe (*Colymbus auritus*), Pied-billed Grebe (*Podilymbus podiceps podiceps*), Bonaparte's Gull (*Larus philadelphia*), Common Loon (*Gavia immer*), Baldpate (*Mareca americana*), Old-squaw (*Clangula hyemalis*), American Golden-eye

*Saunders, Aretas A., The Summer Birds of the Allegany State Park. Roosevelt Wild Life Bulletin, I, No. 3, pp. 235-354, 1923.
Saunders, Aretas A., Additional Notes on the Summer Birds of Allegany State Park. Roosevelt Wild Life Bulletin, III, No. 3, pp. 476-497, 1926.

(*Glaucionetta clangula americana*), Blue-winged Teal (*Querquedula discors*), Greater Yellow-legs (*Totanus melanoleucus*), and the Herring Gull (*Larus argentatus smithsonianus*).

The month of May furnished two records for our list, namely, the Canvasback (*Nyroca vallisneria*) and the Florida Gallinule (*Gallinula chloropus cachinnans*). The latter was sighted in a marsh on the easternmost boundary of the park. The Solitary Sandpiper (*Tringa solitaria solitaria*) was seen in June by Mr. H. Albert Hochbaum.

Some attempt was made to approximate the number of individuals of each species. Totaling of two year count, we find that 273 American Mergansers were seen there. They were by far the most numerous. The Bonaparte's Gulls were next most numerous, followed by the Pied-billed Grebes, the Canada Geese, and the Old-squaws.

Some years ago a pair of Whistling Swans were liberated on Red House Lake and proved to be a wonderful attraction. They remained for several years and then returned no more. In the spring of 1935, however, one swan was seen and it is quite likely that this is one of the pair liberated here previously.

The following partial list will give some indication of the first apperance of some of our songbirds, as compiled from my 1934 records. In this list will be noted three new records for the park, namely, the Ruby-crowned Kinglet, the Myrtle Warbler, and the Fox Sparrow.

March 5—Robin
March 19—Field Sparrow, Meadowlark
March 22—Song Sparrow, Blue Bird
March 30—Baltimore Oriole
April 9—Phoebe
April 12—Flicker
April 17—Chipping Sparrow, Fox Sparrow, House Wren
May 5—Black-throated Blue Warbler
May 6—Barn Swallow
May 8—Chimney Swift, Chestnut-sided Warbler, Towhee
May 10—Black and White Warbler, Purple Finch
May 15—Rose-breasted Grosbeak, Magnolia Warbler
May 18—Kingbird, Indigo Bunting, Red-eyed Vireo

Two unusually large groups of birds were observed during the spring migrations of 1935. On April 12 about 200 Robins were seen feeding on the lawn of the Administration Building. On May 6 hundreds of Barn Swallows were observed feeding over Red House Lake.

Although frosts frequently occur here in the latter part of May, this fact does not seem to defer the arrival of the birds. It was with some misgivings that I consented to guide forty-three members of the Cleveland Bird Club on an early morning walk in the latter part of April, 1935. Much to my surprise, we noted the following thirty-seven species of birds: Common Loon, Horned Grebe, Little Green Heron, Baldpate, Blue-winged Teal, Scaup Duck, Sparrow Hawk, Ruffed Grouse, Spotted Sandpiper, Greater Yellow-legs, Mourning Dove, Kingfisher, Flicker, Hairy Woodpecker, Phoebe, Barn Swallow, Blue Jay, Crow, Chickadee, White-breasted Nuthatch, Robin, Bluebird, Ruby-crowned Kinglet, Starling, Black and White Warbler, Myrtle Warbler, Black-throated Warbler, Meadowlark, Cowbird, Bronzed Grackle, Goldfinch, Towhee, Savannah Sparrow, Slate-colored Junco, Chipping Sparrow, Field Sparrow, and Song Sparrow.

The following winter residents were observed during February, 1935: Belted Kingfisher, Downy Woodpecker, Crow, Chickadee, and White-breasted Nuthatch.

The Ruddy Duck (*Erismatura jamaicensis*), Canada Goose (*Branta canadensis*), Laughing Gull (*Larus atricilla*), and the Common Tern (*Sterna hirundo hirundo*) were sighted in the fall of 1935.

Summary of new bird records for the Allegany State Park: Common Loon, Horned Grebe, Pied-billed Grebe, Whistling Swan, Canada Goose, Baldpate, Blue-winged Teal, Canvas-back, Scaup, American Golden-eye, Buffle-head, Old-squaw, Ruddy Duck, Hooded Merganser, American Merganser, Red-breasted Merganser, Florida Gallinule, Solitary Sandpiper, Greater Yellow-legs, Herring Gull, Bonaparte's Gull, Common Tern, Ruby-crowned Kinglet, Myrtle Warbler, and Fox Sparrow.

I wish to acknowledge the kind assistance given me in the preparation of this paper by Mr. Aretas A. Saunders and Dr. Herbert Friedmann.—Irving William Knobloch, *Allegany State Park, Red House, N. Y.*

Snowy Egrets at Pymatuning Lake, Pennsylvania.—A few days of my vacation were spent at Linesville, Pennsylvania, on the north shore of Pymatuning Lake. There on August 23 I observed about one hundred American Egrets (*Casmerodius albus egretta*) at various points along the Upper Lake. These birds were wary and it was difficult to approach them before they flushed. Among them were several smaller birds of more deliberate and less watchful nature. They permitted a fairly close approach, and as they took wing I could see clearly the yellow toes which indicated them to be Snowy Egrets (*Egretta thula thula*). Two individuals were observed closely enough to make the identification sure. Again on August 25 at the same place I saw about fifty American Egrets and at least one Snowy.

Since a question had been raised as to the authenticity of certain previous sight records of the Snowy Egret in western Pennsylvania, and more especially because the Carnegie Museum had no locally collected specimen, I was advised to return to Linesville and secure one. On September 13—a cold, rainy day—I succeeded in obtaining two Snowy Egrets; both were young males, still showing evidences of molt. American Egrets were still fairly numerous on that date.—Reinhold L. Fricke, *Carnegie Museum, Pittsburgh, Pa.*

The Pileated Woodpecker in Clayton County, Iowa.—In the evening of October 11, 1936, I heard an unusual call, looked up quickly, and about forty feet away, flew a Pileated Woodpecker (*Ceophloeus pileatus abieticola*). He was much larger than our other woodpeckers, with a longer neck and brilliant red crest. He flew with their characteristic undulating motion.

On December 19 I saw him working at the base of an oak tree about sixty feet from the cottage. Again on January 12 he was working on a limb near the top of a tall tree. He bored a hole, then put his bill in, took something out very daintily and ate it.

It was January 29 before I saw him again. He was working on the low limb of a hard maple tree about fifty feet from the cottage. At first he kept on the far side but soon he came out where I got a splendid view of him with my glasses. He spent about ten minutes examining this dead limb. He would tap several times, then it was Stop! Look! Listen!, turning his head first to one side,

then to the other. Deciding there was nothing worth working for, he flew to the other side of the cottage, alighting on an oak tree, and then I saw that his mate was busy at the base where I had seen one the other day.

As far as I know, this is the first time the pair was ever seen together here. The one flew from the tree but the other worked at the decayed base for over half an hour after I first saw it. This gave me plenty to time for its study.

It was working with its back toward me and did not appear to be watching in this direction but was not going to let anything slip up on the other side of the tree. It would take two or three strokes with its bill, then its head would bob around the left side of the tree, and then around the right. Its long neck made this possible without moving its body.

One stroke of its powerful bill, a twist of its head, and a chip flew off. It worked steadily until it had bored quite a hole, then it reached in very carefully and seemed to have found something to eat. It started another place but that was on the live part of the tree so it worked only a little while, then flew away.

I saw the pair again on the hard maple tree. One stayed only a few minutes. The other worked a while, then flew to a nearer tree, and then moved to one about twenty-five feet from me.

They are the most interesting birds I have ever seen, and the most striking in appearance. The body is a dull grayish black, the face is a clear white with a dark streak through the eye, extending a little back. A black streak runs down the back and the front of the neck, and the high crest is a brilliant red. The powerful bill seemed to be partly white. Their attitude was alive and alert, and not timid or afraid, just peppy.—M. Ellen Thornburgh, *McGregor, Iowa.*

Some New and Unusual Bird Records from Utah.[1]—Since 1926 the Department of Zoology and Entomology at Brigham Young University has been attempting to build up a representative collection of Utah birds. This collection now (1937) numbers nearly 1800 study skins and about 200 mounted specimens representing over 250 species and subspecies of the State. A large part of this collection has been obtained through the direct efforts of staff members of the institution, but a considerable number of valuable specimens were obtained from other sources. In 1931 the University obtained about 350 mounted bird specimens from the Latter-Day-Saints Museum of Salt Lake City. Many of these, however, were from localities other than Utah. In the same year fifty mounted specimens of Utah birds were obtained from Mr. R. G. Bee of Provo, and since that time Mr. John Hutchings of Lehi, Utah, has contributed a number of interesting mounted birds including beautiful specimens of the Wood Ibis and the Sandhill Crane.

In the spring of 1937 a series of about 200 study skins of Washington County birds was contributed to the collection by Dr. D. E. Beck and Floyd Atkin of the Dixie Junior College at Saint George, Utah.

During the accumulation of the collection, particularly within the past few years, a number of species and subspecies apparently new to the State, or at least of sufficient rarity to be of interest, have been brought to light. It is the object in this paper to place these occurrences on record and to make some comments as to the distribution of some of the forms within the State.

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[1]Contribution No. 73 from the Department of Zoology and Entomology, Brigham Young University, Provo, Utah.

The writer is indebted to Drs. Clarence Cottam and H. C. Oberholser, of the U. S. Biological Survey, for the identification of some of the doubtful specimens.

Lesser Loon. *Gavia immer elasson.* This subspecies appears to visit Utah in both autumn and spring but as far as I know does not breed within the State. An adult female was collected at the mouth of Provo River, Utah Lake, June 27, 1935, by D. E. Beck. The writer obtained the head and foot only of a specimen shot by a hunter on Utah Lake, October 30, 1932, which on the basis of available measurements seems to be of this subspecies. Still another specimen was collected at Veyo, Washington County, October 27, 1933. As far as I am aware this is the first published record of the Lesser Loon for Utah.

American Egret. *Casmerodius albus egretta.* A mature male specimen was captured alive at St. George, Washington County, by Dr. D. E. Beck and brought to the laboratory at Brigham Young University where it was kept alive for some time during the spring of 1934. It was finally killed and mounted and is now in the display collection of the University. This egret has been formerly recorded from the Bear River Marshes, North End of Great Salt Lake by Bent (U. S. Nat. Mus. Bull. 1935, p. 133, 1926) and by Allee (Scientific Monthly, December, 1926, p. 488). Henshaw (Annals New York Lyceum of Nat. Hist., 11, p. 12, 1874) records it from Beaver, Beaver County, and Provo, Utah County. This bird has apparently always been rather uncommon in the State and is probably less common at the present time than formerly.

Wood Ibis. *Mycteria americana.* A mature specimen was obtained at Lehi, Utah County, during the summer of 1935 by Mr. John Hutchings. It was mounted by him and presented to the Brigham Young University. This species has been recorded from Rush Lake by Henshaw (Report of Expl. and Sur. West of 100th Mer., 5: p. 462, 1875), and from Utah by Ridgway (Manual of N. A. Birds, Philadelphia, J. B. Lippincott Co., p. 125, 1900).

Black-bellied Plover . *Squatarola squatarola.* While undoubtedly a regular migrant visitor to the State, this species does not appear to have been often recorded in State lists. The only published record that I have noted is that of Bent (U. S. Nat. Mus. Bull. 146, p. 168, 1929) from Provo, Utah County, May 11. The writer has been small flocks of this plover at Utah Lake on three occasions. Twelve birds were seen at Provo Bay on May 13, 1933, and a second flock of about the same number was noted flying over the lake on May 20 of the same year. On May 9, 1936, a flock of six birds was seen at Provo Bay and one male was collected from the group. Mr. Reed Fautin, a competent observer, reports having seen about fourteen plovers at the mouth of Provo River, May 5, 1937.

Red Phalarope. *Phalaropus fulicarius.* Two specimens were collected by H. D. Wilkin at St. George, Washington County, October 14 and 15, 1934. The specimens are in typical autumnal plumage and their broad bills at once distinguish them from Wilson's Phalarope and the Northern Phalarope which also occur in Utah. To my knowledge, this is the first published record of this species for the State.

Flammulated Screech Owl. *Otus flammeolus.* One specimen was taken from Pine Valley Mountain, Washington County, October 20, 1935, by Floyd Atkin. Another adult female specimen was taken by the writer and Mr. James Bee at Mule Flat, Mt. Timpanogos, Utah County, July 3, 1937. The last mentioned specimen was removed from her nest which contained two downy white young that we judged to be about ten days old. The nest was in a large aspen tree in what was

apparently an old woodpecker hole and was situated about twenty-four feet from the ground. The bird allowed us to pluck her from the nest and offered little resistance when in hand. Aside from snapping the beak she showed no inclination to fight. The situation was interesting, furthermore, in that there were several nests of the Violet-green and Tree Swallows as well as one Purple Martin nest in the same tree. While this owl undoubtedly is generally distributed throughout the State in suitable habitats, I have not seen it recorded in any of the lists.

Northwestern Horned Owl. *Bubo virginianus lagophonus.* A specimen was collected near St. George, Washington County, October 22, 1933, undoubtedly a migrant individual. I have not noted any previously published record of this subspecies for the State. The status and distribution of the breeding horned owls of Utah are not as yet positively established from our collections. Considerable collecting during the breeding season should be done throughout the State. The Montana Horned Owl (*B. v. occidentalis*) has been established as the breeding subspecies of the Wasatch Mountains east of Provo. Mr. James Bee and the writer obtained a set of partially incubated eggs in South Fork, Provo Canyon, March 21, 1936, and took the female as she left the nest. The nesting site was in a cottonwood tree about fifty feet from the ground. On the same day a set of three eggs, advanced in incubation to the formation of small bones, was taken about one mile west of Charleston, Wasatch County. The nest in this case was also located in a cottonwood tree about fifty or sixty feet from the ground. We have noted that this subspecies also often nests in cliffs along the sides of canyons. The Western Horned Owl (*B. v. pallescens*) is undoubtedly the breeding bird of the southern part of the State, but the exact extent of its range is not evidest from our collections.

Western Nighthawk. *Chordeiles minor henryi.* An adult female was obtained at 10-Mile Spring, south of Escalante, Garfield County, June 22, 1936, by D. E. Beck. Oberholser in his monograph of the genus *Chordeiles* (U. S. Nat. Mus. Bull. 86, pp. 65-70, 1914) does not record this subspecies for Utah, but in his map (ibid., pl. 3) indicates its presence in the extreme southwestern corner of the State. A series of five specimens from the La Sal Mountains, Grand and San Juan Counties, taken by the writer in July, 1934, appear on the basis of Oberholser's descriptions and comparisons, to be intergrades between *C. m. henryi* and *C. m. howelli.* Such an intergradation would be expected on the basis of Oberholser's map of distribution. The establishment of the breeding range of these two subspecies as well as that of *C. m. hesperis* of the western part of the state will require considerable more collecting.

Alaska Hermit Thrush. *Hylocichla guttata guttata.* A specimen was taken on Pine Valley Mountain, Washington County, October 12, 1935, by D. E. Beck. While this subspecies undoubtedly migrates regularly through the State in autumn, this is the first specimen to come into our collection. It was reported by Ridgway (Bull. Essex Inst., 5: p. 170, 1873) as occurring in the Wasatch Mountains in autumn.—C. Lynn Hayward, *Brigham Young University, Provo, Utah.*

Neighborly Wood Thrushes and Other Birds.—The summer of 1936 was marked by the most prolonged heat and drought on record. This had its influence on the feeding habits of the late nesting birds. A pair of Wood Thrushes (*Hylocichla mustelina*) always nest in the yard and are very shy. On July 15 the second brood left the nest. The two young were just able to fly a short distance.

The next morning one of the parents and one of the young were missing. The other parent visited the bird bath of a neighbor and she thought she would try throwing out sime cracker crumbs and bread crumbs. The bread crumbs were rejected but the cracker crumbs were thrown closer and closer to the edge of the porch until we could have reached and touched the parent. She would appease her own hunger and then hop off with a mouth full for the young which always remained at the edge of the yard. The youngsters insisted upon being fed until full grown.

Another bird deprived of food was the Eastern Wood Pewee (*Myiochanes virens*). The parent, in an effort to procure food which was abundant around the foundations of houses, would dash at its prey, often striking a person in its mad flight. The five young of one family perched for the greater part of the day on an apple tree limb about four feet from the ground and were very tame. They, too, insisted upon being fed until grown.

The winter of 1935-1936 here in contrast with other sections of the State, had about three times as many Carolina Wrens (*Thryothorus ludovicianus*) as usual and these all remained for the summer of 1936, raising two large broods each, but in mid-November most of them departed.

During the winter of 1936-1937 the Eastern Mockingbird (*Mimus polyglottos*) and White-throated Sparrow (*Zonotrichia albicollis*) were seen frequently.

The Sharp-shinned Hawk (*Accipiter velox*) has been unusually plentiful here this winter.—Katie M. Roads, *Hillsboro, Ohio.*

Records from Southeastern Missouri—Bennitt's "Check-list of the Birds of Missouri" (Univ. Mo. Studies VII, No. 3, 1933) recorded a number of species and subspecies whose status in Missouri was in doubt. During the summer of 1934 an attempt was made to determine the status of some of them by collecting in the lowland counties of southeastern Missouri. Dr. Harry C. Oberholser has kindly identified the specimens whose names are starred (*). All the birds collected are now in the museum of the University of Missouri.

*Southern Downy Woodpecker. *Dryobates pubescens pubescens. First Missouri record.* Previously reported from points close to Missouri in Kentucky, Tennessee, and Arkansas. There are four specimens from Dunklin County: two females (Cardwell, June 13; Campbell, June 20) and two males (Campbell, June 27).

*Southern Crow. *Corvus brachyrhynchos paulus. First Missouri record.* Previously reported in western Tennessee. A female was taken at Puxico, June 24, and two males at Campbell, June 20 and 27.

*Southern Robin. *Turdus migratorius achrusterus. First Missouri record.* Previously reported from points close to Missouri in Illinois, Tennessee, Arkansas, and Kansas. Two males were taken (White Oak, June 20, and Campbell, June 27), and two females (Kennett, June 21 and 27).

*Maryland Yellow-throat. *Geothlypis trichas trichas. First Missouri specimens.* According to the geographic range of the subspecies of *G. trichas* as outlined in the 1931 A. O. U. Check-List (p. 296), there should be no breeding yellow-throats in Missouri at all. The Northern Yellow-throat (*G. t. brachidactyla*), however, is a common breeder in most of the state, and *trichas* was included in Bennitt's "Check-list" (p. 56) on the basis of rather scant evidence. The presence

of *trichas* in summer in southeastern Missouri was established by two males taken at Cardwell, June 15 and July 5.

*Florida Blue Jay. *Cyanocitta cristata florincola.* First reported from southeastern Missouri in Bennitt's "Check-list" (p. 45) on the basis of three specimens. Six more were collected in Dunklin County during June, 1934, establishing this as the summer-resident race in that region.

*White-breasted Nuthatch. *Sitta carolinensis carolinensis.* Three specimens were taken in Dunklin County during June and July, 1934. In view of the fact that a specimen of the Florida race, *S. c. atkinsi*, from Howell County is now in the National Museum collection, and that Dr. Oberholser has referred two specimens from Central Missouri to this subspecies (Bennitt, 1933, 46), it appears that both races occur in southeastern Missouri.

*Migrant Shrike. *Lanius ludovicianus migrans.* Eight specimens were taken in Dunklin County in June, 1934. Although the Loggerhead Shrike (*L. l. ludovicianus*) has been recorded at points near Missouri in southern Illinois, Kentucky, and Tennessee, *migrans* appears to be the summer-resident shrike of southeastern Missouri.

*Western Parula Warbler. *Compsothlypis americana ramalinae.* Although this race is not now recognized by the A. O. U. Committee and typical specimens of the northern subspecies, *C. a. pusilla*, have been taken elsewhere in Missouri, it is worth recording that four birds taken in Dunklin County during June and July were all referred by Dr. Oberholser to *ramalinae*.

Southern Meadowlark. *Sturnella magna argutula.* Five males were taken in Dunklin County in June, establishing this as the summer-resident meadowlark of the southeastern Missouri lowlands. The only previous specimen from there was one taken by Howell in New Madrid County in 1910 (*Auk*, Vol. 27).

Painted Bunting. *Passerina ciris.* Reported from southern and western Missouri by Bennitt (1933, 60). This species was seen several times during June and July in Dunklin and Stoddard Counties, thus extending its known range in Missouri.—James W. Cunningham, *Southwest High School, Kansas City, Mo.*

ORNITHOLOGICAL LITERATURE

STUDIES IN THE LIFE HISTORY OF THE SONG SPARROW. I. A POPULATION STUDY OF THE SONG SPARROW. By Margaret Morse Nice. Trans. Linn. Soc. N. Y., IV, April, 1937. Pp. i-vi+1-247. Pls. I-III. Charts I-XVIII. Maps 1-14. Tables I-XXXIII. Price, $1.50.

This is Volume I of a monograph based on eight years (1928-1936) of intensive study of *Melospiza melodia,* mostly on an area of about forty acres of Olentangy River flood plain adjacent to the author's former home at Columbus, Ohio. Its scope ranges from statistical presentation of breeding data to critical evaluation of population theory and includes significant discussions of such phases of life history as migration, territorialism, and ecological relationships. Volume II, it is indicated, will be devoted more to details of Song Sparrow behavior, with special regard to activities associated with reproduction.

The principal research technique used was that of field observation, supplemented by color banding. Little experimentation, and no collecting, was done, as it was desired to determine as accurately as possible "What actually happens in a population of wild birds."

One is impressed by the tremendous amount of data that Mrs. Nice has somehow found time to gather, practically through her own efforts alone. As might be expected of a person of her linguistic accomplishments, she has drawn from European, as well as American, ornithological literature. Of the non-English references in the 14-page bibliography, those having German and Dutch titles seem to have been most freely cited.

The subject matter, for all of its bulk and intrinsic complexity, has been clearly handled. Mrs. Nice has expressed the hope that the Song Sparrow work might stimulate further study, and it should do just that. The chapter summaries and the eight pages of index should contribute to this end, but the chief strength of the writing, in my estimation, lies in its essential simplicity of diction, its solidity of background, the trends of thought it reveals, and the questions it raises. Not only has it been the author's evident intention to supply interested readers with the basic facts and up-to-date interpretation of those facts, but she has called attention to a great many of the important hiatuses that still exist in our knowledge of the life history and ecology of vertebrates.—PAUL L. ERRINGTON.

OBSERVATIONS ON THE BIRDS OF WEST VIRGINIA. By Alexander Wetmore. Proceedings of the United States National Museum, Vol. 84, No. 3021. Washington, 1937. Pp. 401-441.

To those who are somewhat familiar with the State's avifauna Dr. Wetmore's paper will hold fewer surprises than to those who have not recognized West Virginia as an outstanding meeting place for many bird species and races. For local students, however, its value is apparent when one finds here listed the first race ever described whose type locality is in West Virginia; no less than nine races recorded from the State for the first time; and the first recorded specimens of at least one species. The present list treats 142 species and races.

Dr. Wetmore directed the Smithsonian Institution's investigation of West Virginia birds during the spring, summer, and autumn of 1936. The party's itinerary was so planned that nearly all major faunal divisions of the State were visited, the work extending from the Ohio River region in the southwestern portion of the

state, up through the rugged hills that lie west of the Allegheny ridges, and eastward to some of the highest mountain areas. Additional data at hand were used, and the specimens already in the National Museum were taken into account. No collections are recorded from that portion of the state which lies in the Shenandoah Valley, nor was any work done in the interesting region comprising parts of Preston, Grant, Mineral, and Tucker Counties which we have come to call the "Allegheny Tableland".

Most surprising, perhaps, of Dr. Wetmore's findings is that Ruffed Grouse in West Virginia are referable to the Canada race, *Bonasa umbellus togata.* This seems to hold true also for the grouse of western Pennsylvania, Virginia, Tennessee, and northern Georgia. In view of the range given for *B. u. umbellus,* the typical form might well be looked for in the extreme eastern part of the state.

Other races recorded from West Virginia for the first time are Southern Crow (*C. b. paulus*), Ohio House Wren (*T. a. baldwini*), Southern Winter Wren (*N. h. pullus*), Southern Robin (*T. m. achrusterus*), Northern Yellow-throat (*G. t. brachidactyla*), Giant Red-wing (*A. p. arctolegus*), Labrador Savannah Sparrow (*P. s. labradorius*), and Mississippi Song Sparrow (*M. m. euphonia*). Illuminating data on the recently described Southern Creeper (*C. f. nigrescens*) and the Northern Carolina Chickadee (*P. c. extimus*) are also included. Specimens of Lapland Longspur were taken, this bird having been known to the state previously only through a sight record.

Concerning the Mississippi Song Sparrow, Dr. Wetmore has determined that the type specimen of the previously named *M. m. beata* Bangs is really a specimen of the Dakota Song Sparrow (*M. m. juddi* Bishop). This leaves *beata* Bangs as a synonym for *juddi,* so *beata* is replaced by *euphonia* Wetmore, the type locality of the race being Cranberry Glades, Pocahontas County, West Virginia.

Eastern bird students will find interest in Dr. Wetmore's belief that the Golden Eagle may still nest in West Virginia. There is a seemingly remarkable coincidence in the collection by the Smithsonian group of another Swainson's Warbler, a previous specimen having been taken by P. C. Bibbee in Monongalia County (Bulletin 258, West Va. Agr. Exp. Station, p. 34).

All breeding birds of the species in West Virginia are considered by Dr. Wetmore to be Cairn's race (*D. c. cairnsi*) of the Black-throated Blue Warbler. The present writer ventures the opinion that individuals of the typical form, *D. c. caerulescens* will be found breeding in the Allegheny Tableland territory in extreme northern West Virginia.

It might be noted that in giving Wardensville, Hardy County, as the northern known limit in West Virginia for Black Vultures, Dr. Wetmore overlooks W. H. Ball's record for Harper's Ferry (*Auk,* XLVIII, Oct., 1931, p. 599). In speaking of the Eastern Purple Finch this paper represents observations on the species made at Cranberry Glades, Pocahontas County, as a considerable southern extension of its summer range. Rev. E. A. Brooks has recorded (List of Birds Found in West Virginia, Bulletin No. 12, W. Va. State Board of Agr., Charleston, W. Va., 1909) the species in summer from The Pines, Randolph County, and from Pocahontas County, near Osceola. He also quotes Thaddeus Surber's record of the summer occurrence of the species in Greenbrier County, farther south than the Cranberry Glades area. Maurice Brooks has noted previously the summer occurrence of the birds at Cranberry Glades (Wilson Bulletin, XLII, Dec., 1930, p.

249). Throughout Dr. Wetmore's paper Kate's Mountain, where considerable collecting was done, is consistently misspelled.

When it is possible to record from an eastern state nine races of birds previously unknown, or only recently known, from the area, further emphasis is given to the need of extensive field work in West Virginia. Dr. Wetmore's collections, taken together with the excellent work on West Virginia avifauna being carried on by Dr. George M. Sutton, Karl Haller, and others, will make the work of the compiler much easier, and will add richness to the next check-list of West Virginia birds.—MAURICE BROOKS.

A SURVEY OF THE RESIDENT GAME AND FURBEARERS OF MISSOURI. By Rudolf Bennitt, Ph. D., and Werner O. Nagel, A. M. Univ. Mo. Studies, XII, No. 2, April, 1937. Pp. 1-215. 8 figs. 10 maps. Price, $1.25.

The authors of this survey have produced a report which may serve as a model for similar work in other states. The plan of the work includes some general statements as an introduction, followed by chapter discussions of selected game birds, game mammals, furbearers, and predators. Approximately half of the report is devoted to game birds. The species included are the Bob-white, Ruffed Grouse, Prairie Chicken, Ring-necked Pheasant, Wild Turkey, Mourning Dove, and a few others merely mentioned.

The Ruffed Grouse population in Missouri is reported to consist of about 100 birds. The population of Prairie Chickens is estimated at about 5,000 (as contrasted with 12,500 in 1907). The southern half of the state is credited with a population of 3,585 Wild Turkeys, which, on the whole, is decreasing. Missouri is one of the states which counts the Mourning Dove a game bird. This again brings to our mind the question of how a game bird is defined. Is it defined by its edibility? Is it defined by its abundance? Is it defined by the skill required in shooting it? Or is it merely a traditional term without exact meaning, except in a legal sense? In some not very clear way the term "game" bird is associated with the idea of sport. And, similarly, we usually think of sport as a test of skill and prowess. The estimated population of Mourning Doves in the State of Missouri in the fall of 1934 is 3,000,000. Subtracting 30 per cent for loss by predators, weather, etc. (as was done in the quail estimate, which may or may not be justified in this case) we would have a spring population of 2,100,000 birds to compare with the estimate of 1,065,000 Bob-whites for the spring of 1935. These figures would indicate about twice as many Mourning Doves as quail in Missouri. This puts the Mourning Dove in a worse position than we had supposed it to be. The Bob-white, with a higher reproductive capacity than the Mourning Dove, is barely holding a stationary population in Missouri. What can be expected of the Mourning Dove, with a lower reproductive capacity, granting two or three broods per season, and a much longer open season? The authors' comment on this is, "that any amount of dove shooting likely to occur in Missouri for the next few years will not endanger the breeding reserve". Of course, during Missouri's open season they have not only their own birds, but those from the northern states as well; unless their breeding population moves southward, in which case the hunted population would all be northern. To work out this problem one would need the full facts of migration. It seems clear enough that while any state may properly regulate its own resident game, the problem of migratory species can only be solved by considering its entire range.

The pages of this report which deal with mammals are as complete and thoughtful as those on birds. The entire case of the proper handling of our wild life is helped by just such contributions as the one under discussion. This is a fact-finding paper, and as such is entitled to serious consideration by interested students in any state. The last five years will no doubt mark the beginning of a renaissance in wild life management in this country, and work of the kind here reviewed will stand as a landmark in its history.—T. C. S.

HANDBUCH DER DEUTSCHEN VOGELKUNDE. Volume I: Passeres. By Gunther Niethammer. Pp. i-xxiv+1-474. Figs. 69 and Col. Pl. I. Published by the Academische Verlagsgesellschaft M. B. H. Leipzig, 1937. Price, 15 RM.

As the title indicates this is a handbook of German ornithology, the present, first, volume dealing wholly with the passerine birds. While it is written in the German language, the English alphabet is used, thus facilitating translation for us. A few more than two hundred forms are treated, each under the subheads: description; field marks, including song; general distribution; distribution in Germany; migrations; habitat; breeding habits; food; parasites. The Europeans have given much more attention to parasites than Americans have done, and consequently a good list of various parasites can be given for practically every bird species treated. The paragraph on breeding habits (fortflanzung) is very fully presented, including the facts concerning the nest, eggs, care of the brood, incubation period, and nestling period. We have enjoyed going through this volume not only for the information gained by comparison of the nomenclature and other descriptions with our own, but we have found it a most profitable exercise in strengthening our reading ability in the German language. And for the same reasons we believe that many an American ornithologist would find this work a very useful addition to his library.—T. C. S.

BIRDS COLLECTED BY THE CHILDS FRICK EXPEDITION TO ETHIOPIA AND KENYA COLONY. By Herbert Friedmann. U. S. Nat. Mus. Bull. 153, Pt. 2, Passeres. xii + 506 pp., 14 pl. (1 col.), 30 figs. Washington, 1937. Price, 70 cents.

By our unofficial count this work treats of 295 species and 58 additional subspecies. Part 1, published in 1930, contained about the same, making a total of 613 forms. It is based primarily upon some 5,200 specimens collected by the late Dr. E. A. Mearns. The treatment consists chiefly of discussions of the status of the forms examined with new details of plumage, etc. The general reader will find frequent notes on habits. Common names are mentioned for many of the birds but they are not placed in the headings, except for families, nor indexed. It is always interesting to examine an account of a distant region. In this second part of the report, the weaver-birds are the most numerous family with fifty-eight nominal species. The warblers (Sylviidae), thrushes, and shrikes are next in order, with subspecies decidedly most numerous in the warblers. In the weaver-birds we find four species of *Passer*, of which *P. griseus swainsoni* in Ethiopia "takes the place of *P. domesticus* in a general way". The text figures are mostly distributional maps and the plates mostly photos of habitats. A brief discussion (pp. 3-15) of faunal areas is included. The author states that a report on the birds of the Roosevelt African expedition is in manuscript.—O. A. S.

CONCORD RIVER. SELECTIONS FROM THE JOURNALS OF WILLIAM BREWSTER. Edited by Smith O. Dexter. Pp. i-x+1-259. Harvard University Press, Cambridge, Mass. 1937. Price, $3.50.

Concord River is a companion for October Farm, which was published last year. The notes in Concord River begin with 1879 and extend to 1918, though the bulk of those selected were written in the 90's. This is a larger book than October Farm, and it seems to us that it contains more bird material; though we do not find it any more interesting. Concord River in enhanced, however, by having a detailed map of the October Farm region. Many of the bird notes scattered in this diary have quotation value, such as, for instance, the whisper song of the Brown Thrasher (p. 37), the flight songs of the Flicker and the Pine Warbler (p. 196), the eating of petals of apple blossoms by the Cedar Waxwing (p. 188), and many others. Brewster also witnessed the very extraordinary incident of a male Downy Woodpecker attacking and killing a female Downy. On several occasions, Brewster relates, he saw a hawk or a shrike capture its prey, and was so vexed that he was tempted to shoot the predator on the spot, but refrained. The illustrations are for those who like that kind.—T. C. S.

FLIGHT SPEED OF BIRDS. By May Thatcher Cooke. Circ. 428 U. S. Dept. Agric., May, 1937. Pp. 1-13. Price, 5 cents.

A useful brief discussion of bird flight as affected by body weight, shape of wings, and wind currents, together with a very full list of birds with determined flight speed. A good bibliography of eighty-six titles is also given.—T. C. S.

FLUCTUATIONS IN NUMBERS OF RUFFED GROUSE BONASA UMBELLUS (Linne) with Special Reference to Ontario. By C. H. Douglas Clarke. Univ. Toronto Biol. Studies No. 41. Univ. Toronto Press, 1936. Pp. 1-118.

A paper which discusses especially population numbers, life history, cycles, parasites and diseases in the Ruffed Grouse species.—T. C. S.

VERTEBRATE ANIMALS OF POINT LOBOS RESERVE, 1934-35. By Joseph Grinnell and Jean M. Linsdale. Pub. 481 Carnegie Inst. of Washington. Washington, 1936. Pp. i-vi+1-159. Pls. 1-39. Fig. 1.

The Point Lobos Reserve is a state park located near the middle of the California coast line. The body of this report includes annotated lists of amphibians (five in number), reptiles (five in number), birds (147), and mammals (19), which were found in the park during the period of study. In their listing of species the authors use the binomial nomenclature, since no specimens were collected upon which to base subspecific determination. The authors advocate the administration of this park in such a way as to preserve its natural conditions intact, and a strong plea is made for this policy.—T. C. S.

NATURAL HYBRIDIZATION AND GENETICS OF FLICKERS (COLAPTES). By Alan Deakin. Amer. Nat., LXX, Nov.-Dec., 1936, pp. 585-590.

A study of the genetics based on two families. We have long wished to know something about the chromosome count in such closely related forms as the flickers, and especially in the hybrids.—T. C. S.

The *Chat* is a new mimeographed periodical issued by the North Carolina Bird Club, and published at Raleigh, N. C., at $1.00 per year. The editor is John H. Grey, Jr., 1719 Park Drive. In the March number (I, No. 1, 1937) one writer tells of having seen a Ruby-crowned Kinglet with a *yellow* crown patch instead of a ruby-colored one. This variation in color may be a local strain, since very little has been written about such a color variation in the general literature. The April number (I, No. 2) has an important article by C. S. Brimley on "Additions, Corrections to North Carolina Birds" as developed since the "Birds of North Carolina" was published in 1918. There is also a report of the nesting in North Carolina of the Prairie Horned Lark. The May-June number (I, Nos. 3-4) prints an article by Editor Grey on birds to be seen on the Atlantic Ocean. This number also reports 101 charter members of the newly organized society. The July-August number (I, Nos. 5-6) presents an article by Dr. T. Gilbert Pearson reviewing the present status of bird protection in South and Central American countries. Another writer records the decrease in numbers of Purple Martins, and believes the cause to be the use of a poisonous spray used by the Brazilian coffee growers. Another paper on the breeding habits of the Least Tern reports many eggs on the North Carolina coast as early as May 18.

The *Nebraska Bird Review* for April (1937, V, No. 2) carries a suggestive article by Prof. O. A. Stevens on bird banding, and also a very complete biography of the late Professor Lawrence Bruner, with a portrait and list of published works. The July number (1937, No. 3) presents another instalment of Professor Swenk's history of Nebraska ornithology. This instalment deals with the several small expeditions up the Missouri River which followed the one by Lewis and Clark. Previous instalments covered fossil birds (April, 1933), aboriginal man and bird life (October, 1934), early Spanish explorations (April, 1935), the Lewis and Clark expedition (July, 1935).

The *Redstart* for April (1937, IV, No. 7) presents an article by Dr. George M. Sutton on available problems in West Virginia ornithology, which may be of interest to others also. We note with appreciation the very nice compliment from the editor of the *Redstart*. In the May number Mr. Maurice G. Brooks calls attention to a list of about seventeen species of birds which might be found nesting in Preston County. Such suggestions promote ornithology by stimulating those who have the opportunity to investigate.

News from the Bird Banders for August (XII, No. 3, 1937) lists the banders who participated in the work of the W. B. B. A. for 1936. It shows that 37,951 birds were banded by 122 banders. This issue reproduces a comment from the WILSON BULLETIN, evidently with approval.

The *Inland Bird Banding News* for June (1937, IX, No. 2) gives a historical account of the campaign of gull banding in the Great Lakes region. M. J. Magee reports having banded 28,424 birds (3,141 of which were Evening Grosbeaks) during the fifteen years (to May 28, 1937) of his banding activities.

The *Game Research News Letter* for August, 1936, issued at Madison, Wisconsin, carries a supplement which gives very full information concerning the game management training work as offered at the University of Wisconsin under Professor Aldo Leopold. The August, 1937, number introduces the four leading

graduate students of the department, stating their present employment; and also enumerates six of the research projects now being worked on.

The *Chickadee* for December, 1936 (VI, No. 1) contains a composite list of the birds found in Worcester County during the year 1936.

The *Prothonotary* for June, 1937 (III, No. 6) includes a composite one-day list of 184 species of birds. There is also an eye-witness account of the way young Wood Ducks leave the nest. In this case, at least, the young birds tumbled out of the nest and fell to the ground without any assistance from the parents. The July number is devoted mainly to nesting records. The August number is devoted to brief records.

The *Migrant* for June, 1936, reports two colonies of Cliff Swallows in Tennessee. One colony is on the Cumberland River at Dover. The nests were cemented to the concrete wall of a dam. Later nests were added below the older ons. One nest had a bottle-neck entrance which "hung down for more than a foot". Another colony was found on the Tennessee River thirteen miles below (north of) Savannah, Tenn. These nests were attached to a natural rock cliff. The authors suggest that these colonies are the "most southerly breeding sites of this species at the present time". Mr. Weakly continues the topic in the September *Migrant* and reports several other small colonies along the Cumberland River in Tennessee and Kentucky; and also along the Tennessee River, one of these being in northern Alabama. Two of the mud nests were occupied by snakes, each one of which contained an adult swallow. The December number (VII, No. 4) has an article by Mr. Coffey on the Chimney Swift migration at Memphis, which describes another banding project on a large scale. In the number for June (VIII, No. 2) Mr. Ganier records a list of sixty-nine species of birds for the Pickett Forest, wilderness area in the northeastern part of the state.

The *Cardinal* for July (IV, No. 6, 1937) contains a paper on the breeding birds of unglaciated Ohio, by Lawrence E. Hicks, and notes from West Virginia, by Maurice G. Brooks, as well as many short notes and reviews.

The *Raven* for April-May (1937, VIII, Nos. 4-5) contains a report of the Seventh Annual Meeting of the Virginia Society of Ornithology, and an intimate account of the flight song of the Woodcock. The June number (VIII, No. 6) has for its leading article a description, by Dr. J. J. Murray, of the birds found on Cobb's Island on a June visit.

The *Journal of Minnesota Ornithology* is published by the T. S. Roberts Ornithology Club as an annual. The number for April, 1937 (I, No. 2), contains an article by Cyril J. Rosenberger summarizing noteworthy discoveries of birds during 1936. A Magpie invasion is described by J. P. Jensen. There is also a short paper reporting the Whooping Crane near Wolsey, S. D., on July 30. 1936.

The *Flicker* is published quarterly by the Minnesota Bird Club. Beginning with the March number for 1937 (IX, No. 1) it appears in printed form, with an attractive cover design. This number gives a ten-year list of winter birds in Minnesota as compiled from the literature by E. D. Swedenborg. The May number (IX, No. 2) contains a list of the summer birds of Cook County, also by Mr. Swedenborg. The *Flicker* is edited by George N. Rysgaard.

The *Wildlife Review* for July (No. 9, 1937) contains just a hundred abstracts of papers dealing with wildlife, and classified under the usual headings.

The *Bird Calendar of the Cleveland Bird Club* for April and May (July, 1937) gives a list of unusual birds observed locally during the spring; and also a list of spring arrival dates.

"Cleveland's Nature Trails" is the title of a booklet prepared by Dr. Arthur B. Williams and published by the *Cleveland Press*. These pages give a descriptive account of a number of natural history aspects of the Cleveland area, for example, the park areas, birds, trees, woodland flowers, mammals, plant growth, etc. Besides being of local interest, this booklet is very suggestive to other communities which might wish to plan something of a similar kind. A copy may be had by sending ten cents to the Cleveland Press, Public Service Bureau, Cleveland, Ohio.

The *Bulletin of the Schools* of the University of the State of New York uses one issue each year as a Bird Day number, and this year it was the March number. In it we find twenty pages of popular reading matter on bird life, including a paper on the movements of birds by Dr. Dayton Stoner.

The Outdoor Nature Club, of Houston, Texas, has issued a 4-page spring (1937) Bulletin. Further information concerning it may be secured by writing Mr. Chas. B. Boone, 2524 Cragmont St., Houston, Texas.

"Fuertes and Audubon, a Comparison of the work and personalities of two of the World's Greatest Bird Artists" is the title of an article by Dr. Frank M. Chapman in *Natural History* for March, 1937, a reprint of which was kindly sent us by the author.

Donald J. Boror has prepared a mimeographed report on the migration dates for the birds of central Ohio, issued in March, 1937.

The *Bluebird* is the new name for the News Letter of the Audubon Society of Missouri, beginning in February of this year. The February number (IV, No. 2, 1937) has a good article on the winter food of birds. In the March number (IV, No. 3) a writer tells of a House Wren's nest built on the rear axle of an automobile. When the car was used the nest and mother bird went along, being twice gone all day. The five eggs were successfully hatched. In the June number (IV, No. 6) the Editor offers some comments on the growing use of poisoned bait for the destruction of certain animals which come under human ban. The question is raised whether these burrowing rodents may not perform some beneficial service in soil development. Mankind has made some costly blunders in draining away the surface waters and loosening the top soil—all due to haste and ignorance. It may later be discovered that much of the poisoning work is in the same category. This periodical has been running a good deal of discussion on the extent to which birds eat butterflies. Other discussion considers the good and bad points of the English Sparrow, and of the grackle and bluejay (mostly bad points in these two cases). In the August number (IV, No. 8) Mr. G. E. Moore advocates the inclusion of introduced wild species in our daily lists.

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